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THE
UNIVERSITY OF MISSOURI
BULLETIN
VOLUME 16 NUMBER 1

GENERAL SERIES
1915, No. 1

ANNOUNCEMENT
OF THE
GRADUATE SCHOOL
1915-1916



UNIVERSITY OF MISSOURI
COLUMBIA, MISSOURI
January, 1915

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UNIVERSITY OF MISSOURI
COLUMBIA, MISSOURI
January, 1915

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ANNOUNCEMENT OF THE GRADUATE SCHOOL

GENERAL STATEMENT

Admission:

Graduates of the colleges and universities comprising the Missouri College Union and of other reputable colleges and universities are admitted to the Graduate School. Admission to this school, however, shall not be understood as implying admission to candidacy for advanced degrees, which is subject to the regulations indicated below. Students are admitted to the Graduate School by the Dean of the University Faculty to whom applications for admission should be addressed.

Fees and Expenses:

Students are required to pay a library, hospital, and incidental fee of \$10 a semester. Those who file their study cards after the first Thursday of the first semester or the first Tuesday of the second semester will be required to pay an additional fee of \$5 for late registration. Students taking laboratory work must make small laboratory deposits. The estimated cost of room rent and board for students living in Lathrop or Benton Hall, the dormitories for men, varies, according to the room, from \$3 to \$3.50 a week. In Read or Sampson Hall, the dormitories for women, it varies, according to the room, from \$5.75 to \$6.25 a week. The total necessary expenses of a student living in the dormitories for men need not exceed \$225 a year; in the dormitories for women they need not exceed \$250. The necessary expenses for students living in private families vary from \$4 to \$6 a week.

University Fellowships and Scholarships:

The University offers annually a limited number of University Fellowships yielding each a stipend of \$400 a year. These fellowships will be awarded, according as the applicants, irrespective of department, have demonstrated their ability to render service in the form of research. The University offers also a limited number of scholarships bearing stipends of \$200 annually, open to graduate students of high promise in scholarship, irrespective of the lines of work they may desire to pursue. It is expected that scholars will be well qualified to do graduate work in the subjects which they elect, and that they will devote themselves mainly to work in these subjects. They will be called upon to render a limited amount of service to the University. University fellows and

scholars are allowed to engage in outside work only with the consent of the Dean of the Graduate Faculty and the professor of the subject which they elect. The Executive Board, upon the recommendation of the dean and professor, may deprive any student of his fellowship or scholarship, whenever it may appear that he is not devoting himself as he should to his work as fellow or scholar. Applications must be filed not later than March 1, in order to receive consideration in the award for the following academic year. Applications received after this date and not later than June 1 will be considered in filling any vacancies that may occur in the fellowships or scholarships. Application blanks may be obtained from the Registrar of the University and when filled out should be sent to the President of the University, Columbia, Missouri.

Gregory Fellowships and Scholarships:

By the terms of the will of the late Charles R. Gregory of St. Louis, Missouri, the residue of his estate, amounting to approximately \$225,000, after providing for numerous bequests to charitable institutions, was left to the University of Missouri at Columbia to establish "The William Alexander Gregory Educational Fund." This must be invested by the Board of Curators "in a safe and prudent manner, the income from which shall be used in assisting white students of either sex in obtaining an education in any of the courses in said institution."

The Board of Curators has seen fit to provide that not more than \$1500 annually from this income may be used for the establishment and maintenance of fellowships and scholarships in the Graduate School to be known as the "Gregory Fellowships and Scholarships." These are awarded on the same conditions as the University fellowships and scholarships.

Peabody Fellowship in Education:

In June, 1912, the trustees of the Peabody Education Fund gave the University the sum of \$6,000 on condition that it be held and used as an endowment of a Peabody Graduate Fellowship in education. The annual income from this fund will be paid to the holder of the fellowship.

Curators' Scholarships:

By order of the Board of Curators, the student who attains the highest grade, or who shall be first in merit, in taking a bachelor's degree, in the graduating class of any of the colleges or universities composing the Missouri College Union, will be admitted to this University for the first year without the payment of tuition, library, hospital, and incidental fees.

Agricultural Research Fellowships and Scholarships:

The University offers annually a limited number of research fellowships in the Agricultural Experiment Station, each of the value of \$400,

and scholarships, each of the value of \$200. It is the purpose of these fellowships and scholarships to foster and encourage original investigation and to give opportunity to students who desire to become efficient investigators in the field of agricultural science. All candidates for these fellowships and scholarships must fulfil the requirements for admission to the Graduate School of this University. (See page 3.)

These fellowships and scholarships are available in the departments of agricultural chemistry, animal husbandry, dairy husbandry, horticulture, botany, entomology, farm crops, and soils. They will be awarded to the candidates who are best prepared and are of the highest promise in scholarship. Application blanks for these fellowships may be obtained from the Director of the Agricultural Experiment Station, Columbia, Missouri. Applications must be filed not later than March 1, in order to receive consideration in the award for the next academic year. Applications received after this date will be considered in filling any vacancies which may occur in these fellowships.

United States Department of Agriculture Research Fellowship in the Improvement of Cereal Crops:

The Bureau of Plant Industry of the United States Department of Agriculture has recently provided for a fellowship in cereal crops in the University of Missouri, bearing a stipend of \$400. This is the only fellowship of the kind offered in the United States. It is to be awarded to a graduate student in the University who has received special training for such investigations.

The purpose of these investigations shall be (a) to improve the cereal crops of the Central Mississippi Valley region as regards yield, quality, disease resistance, earliness, stiffness of straw, winter-hardiness, etc.; (b) to determine the best methods of cereal production; and (c) to study the fundamental laws of breeding and inheritance in cereals.

Literary and Scientific Societies:

A number of literary and scientific societies are maintained in the University.

The following, conducted by members of the faculties, are open to advanced students: "The Scientific Association," organized with a "General Section" and special sections of "Biological Science," "Mathematical and Physical Science," and "Social and Political Science;" "The Philological Club," "Mathematical Journal Club," and "The University of Missouri Section of the American Chemical Society."

The following, among others, are conducted by students, in some cases with the participation of members of the faculties: "Medical Society," "Engineering Society," "Der Deutsche Klub," "French Club," "Sketch Club," "Asterisk Club," "History Club," "Branch of the American Institute of Electrical Engineers," "Branch of the American Society of Mechanical Engineers," "Physics Club," and "Forestry Club."

Publications:

The "University of Missouri Studies," several series in "The University of Missouri Bulletin," and the "Publications of the Agricultural Experiment Station" are maintained as a means of publishing the results of original research in the University by instructors and graduate students.

University Libraries, Laboratories, and Museums:

LIBRARIES. The University libraries comprise the general library and many departmental libraries. They contain about 175,000 volumes and pamphlets. Students have access also to the library of the State Historical Society of some 65,000 volumes and pamphlets.

LABORATORIES. Facilities for research in the sciences are provided in the following laboratories: animal husbandry, anatomy, astronomy, bacteriology, botany, chemistry, agricultural chemistry, dairy husbandry, engineering (civil, electrical, sanitary, and mechanical), entomology, experimental psychology, educational psychology, farm crops, geology and mineralogy, horticulture, pathology, pharmacology, physics, physiology, physiological chemistry, soils, veterinary science, and zoology.

MUSEUMS. There are also museums of art, classical archæology, ethnology, geology, and other collections.

Regulations Governing the Degree of Master of Arts:

The degree of Master of Arts is offered to students who have spent at least one year exclusively devoted to advanced courses of study, and who have submitted an acceptable dissertation and passed all prescribed examinations.

A student wishing to make application for this degree must fill out a blank form, provided for the purpose, and must present it to the Dean of the Graduate Faculty on or before October 15.

In order to be accepted as a candidate for the degree, the student must give evidence that he has completed an undergraduate course of study such as is offered by colleges of good standing and that he has received a baccalaureate degree equivalent to the baccalaureate degree of the University of Missouri.

In making application the student must indicate the subject of the dissertation and the course of study selected by him on the form referred to above, which must bear the signature of approval of the professor in charge of his major subject, before it is presented to the dean for final action. He may, however, defer submitting the subject of the dissertation to the dean until November 1.

The candidate must choose a major subject, to which he must devote the greater part of his time during the year, and also such other subjects as may be approved. A majority of all work represented in the course of study must be selected from the courses strictly graduate in character.

A dissertation evincing capacity for original research and independent thought in the subject of the major work must be submitted to the Gradu-

ate Faculty for approval on or before May 15. The student should consult the Dean of the Graduate Faculty for information regarding the form in which the dissertation must be presented.

Each candidate for the degree of Master of Arts shall be required to pass final examinations, but the Graduate Faculty, upon the recommendation of the faculty of the department in which the candidate is taking his major work, may excuse the candidate from the requirement of a dissertation.

The attention of students is called to the fact that graduate work cannot be subjected to rigid regulation, and the Graduate Faculty reserves the right to deal with each case on its individual merits.

With the approval of the professors concerned, such candidates as have fulfilled all requirements may, at the close of the year, be recommended by the Graduate Faculty for the degree of Master of Arts.

Regulations Governing the Degree of Doctor of Philosophy:

1. **GENERAL STATEMENT.** The degree of Doctor of Philosophy is offered to students who have pursued advanced courses of study, without serious interruption, for a period of at least three years, and who have submitted an acceptable dissertation and passed all prescribed examinations.

In order to be accepted by the Graduate Faculty as a candidate for the degree of Doctor of Philosophy, the student must give evidence that he has completed an undergraduate course of study such as is offered by colleges of good standing and that he has received a baccalaureate degree equivalent to the baccalaureate degree of the University of Missouri.

The faculty reserves the right to decide in each case whether the antecedent training has been satisfactory, and, if any of the years of advanced work have been passed away from this University, whether they may be properly regarded as spent in university studies under suitable guidance and favorable conditions. Private study or study pursued at a distance from libraries and laboratories will not be considered as equivalent to university work. In any case, the student must spend the year immediately preceding his final examinations in residence at the University of Missouri.

It should be emphasized that the requirements for this degree are not computed in terms of time and courses, but that the degree is conferred only upon such students as have reached, after long study, a high attainment in some special branch of learning and have given the clearest evidence of their ability to carry on independent, original research by reason of having made an actual contribution to knowledge of a character approved by competent judges.

2. **ACCEPTANCE OF CANDIDATES.** A student wishing to make application for the degree of Doctor of Philosophy must fill out a blank form,

provided for the purpose, secure thereto the signatures of the instructors with whom he desires to take his major and minor subjects and present it to the Dean of the Graduate Faculty for approval on or before October 15. He must also give satisfactory evidence of ability to translate French and German readily at sight.

3. REQUIREMENTS FOR THE DEGREE. (a) Subjects of Study.—Every candidate for the degree must select one principal or major subject, and at least one and not more than two subordinate or minor subjects, the combination to be approved by the Graduate Faculty. The instructor with whom the student is taking his major subject acts as his official adviser and has the general direction of his work.

The student's principal work must be in the major subject. Although no regulations are laid down with respect to the time to be devoted to the major and minor subjects, in general it may be stated that the major subject should represent two-thirds of the student's entire time.

(b) Dissertation.—The dissertation, embodying the results of original investigation, must be written upon a subject approved by the adviser and must be submitted in typewritten form on or before May 15, when it becomes the property of the University. The student should consult the Dean of the Graduate Faculty for information regarding the form in which the dissertation must be presented.

Upon receiving the dissertation a committee is appointed whose duty it is to report upon it in writing to the Graduate Faculty.

The candidate is required to print or publish the dissertation, with such revision as the faculty may allow, and he shall present 150 copies of the work to the library of the University. The faculty shall take any necessary action to insure the publication of the dissertation within one year after the conferring of the degree. A brief biographical sketch of the writer must be appended to the dissertation.

(c) Examinations.—A committee, consisting of the professor of the candidate's major subject and the professors of his minor subjects, is appointed to take charge of all examinations, and to report upon the same to the Graduate Faculty in writing.

In addition to final written examinations the candidate may be required to take an oral examination in the presence of the faculty.

(d) Conferring of Degree.—Upon the satisfactory completion of all requirements, the candidate may be recommended by the Graduate Faculty for the degree of Doctor of Philosophy.

COURSES OF INSTRUCTION

Courses preceded by a number with the letter a attached, thus: 104a, 106a, are given the first semester only. Those preceded by a number with the letter b attached, thus: 104b, 106b, are given the second semester only. Those preceded merely by a number are continuous courses and are given both semesters. The number of hours' credit given for a course for each semester is indicated by the Arabic numerals following the statement of the course. Courses numbered 200 and above are strictly graduate in character.

GROUP OF CLASSICAL LANGUAGES

CLASSICAL ARCHAEOLOGY

106. **History of Greek Art.** A preliminary study of Assyrian and Egyptian art, followed by a study of the development of Greek architecture and sculpture. Lectures, collateral reading, essays, with constant use of the lantern, photographic reproductions, and models and casts in the Museum of Classical Archaeology. Ancient history is recommended to the students of this course. (3) Mr. PICKARD.

107a. **Mycenaean Art or Art of Primitive Greece.** The earliest discoveries at Mycenae, Tiryns, and elsewhere will not be neglected, but special attention will be given to the most recent publications on Troy, Crete, and the Argive Heraeum. (1) Mr. PICKARD.

108b. **Introductory Study of Greek Vases and Vase Paintings.** (1) Mr. PICKARD.

While a knowledge of the Greek language is not an absolute prerequisite for courses 107a and 108b, they are intended for advanced students in Greek.

109. **Etruscan and Graeco-Roman Art.** Should be preceded by course 106. It will deal with the earliest art of the Italian Peninsula, endeavor to show how this art reached its highest development among the Etruscans, how Etruscan influenced early Roman art, how later Roman art grew out of early Roman and late Greek art modified by the circumstances and character of the Romans. Ancient history is recommended to students in this course. (2) Mr. PICKARD.

110. **Roman Life.** A systematic study of the topography of Rome and of extant remains particularly of Rome and Pompeii. Lectures and readings. Illustrated by the use of plans, maps, and lantern slides. As supplementary to this course, Latin, course 105, is recommended. (2) Mr. PICKARD.

214. **Topography and Monuments of Athens.** Frazer's Pausanias will be taken as the basis of discussion. A reading knowledge of Greek, French, and German is required. (2) Mr. PICKARD.

215. **Archaeological Seminary.** Hours and work to be arranged. Mr. PICKARD.

For courses in the history of art, see page 41.

GREEK

113a. **The Greek Theater.** The origin and development of the Greek theater will be considered and disputed points in the structure of the theater and in the presentation of plays will be discussed. The basis of the work will be Doerpfeld and Reisch's *Das Griechische Theater*. (1) Mr. MANLY.

114b. **Aristophanes.** Selected comedies will be read and the origin and development of comedy will be considered. Attention will also be given to the life of the people as revealed in the plays. (2) or (3) Mr. SCOGGIN.

216. **Hesiod and Homeric Hymns.** Students should provide themselves with *Hesiodi Carmina* ed. A. Rzach, Teubner, Leipzig, and *Hymni Homerici* ed. A. Baumeister, Teubner, Leipzig. (2) or (3) Mr. HAYS.

217. **Homer.** The whole of the Iliad and the Odyssey will be read during the year with especial attention to the antiquities. A special subject will be assigned each student for investigation. Teubner text editions of the poems should be secured in advance. (2) or (3) Mr. MANLY.

218a. **Historical Greek Grammar.** Phonology and morphology. The lectures will deal systematically with noun and verb inflection within the Greek language itself. The student should procure Brugmann's *Griechische Grammatik* and Solmsen's *Inscriptiones Graecae ad illustrandas dialectos selectae*. (3) Mr. SCOGGIN.

219b. **Historical Latin Grammar.** The sounds and inflections of the Latin language will be set forth briefly in lectures. The student should own Lindsay's *Latin Language* and the same author's *Latin Inscriptions*. (3) Mr. SCOGGIN.

220. **Elementary Sanskrit.** Elements of the language. Translation of Sanskrit into English and English into Sanskrit. Thorough drill in forms. Whitney's *Sanskrit Grammar*; Lanman's *Sanskrit Reader* and Perry's *Primer*. (3) Mr. SCOGGIN.

221. **Seminary.**

LATIN

104. **Latin Prose Composition.** Prerequisite: course 50. (1) Mr. HAYS.

105. **Roman Public and Private Life.** Prerequisite: courses 30 and 70. Reading of Cicero's correspondence and Juvenal's satires. Course 105, alternating with course 110, will not be given in 1915-16. (3) Miss JOHNSTON.

Students electing this course are advised to take with it History, course 190a.

106. **Catullus and the Elegiac Poets.** Prerequisite: courses 30 and 70. Course 106, alternating with courses 109a and 125b, will not be given in 1915-16. (3) Mr. COLBURN.

109a. **Latin Comedy.** Prerequisite: courses 30 and 70. Representative plays of Plautus and Terence. (3) Mr. HAYS.

110. (a) **Tacitus, Annals;** (b) **Quintilian, X-XII.** Prerequisite: courses 30 and 70. (3) Mr. COLBURN.

111. **Rapid Reading.** Prerequisite: course 105. History of Latin literature, with readings from authors representative of each period. (2) Mr. COLBURN.

125b. **Lucretius.** Prerequisite: courses 30 and 70. (3) Mr. HAYS.

217. **Seminary.** Graduate work in Latin centers in the seminary. The subject for 1915-16 will be Cicero's ideal of rhetoric as set forth in his writings on oratory, with intensive study of *De Oratore*. (3) Miss JOHNSTON.

220. **Vergil's Aeneid.** Comparative literary study of epic poetry; structure and versification; antiquities and topography. Intended primarily for teachers. (2) Mr. MILLER.

Historical Latin Grammar. See Greek, course 219b.

The Teaching of Latin. See Education, course 139b.

GROUP OF MODERN LANGUAGES

ENGLISH

104. **Literature of the Nineteenth Century.** A comprehensive lecture and reading course in modern English literature. The first semester will be devoted primarily to the Romantic period; the second semester, to the Victorian era. (3) Mr. TISDEL.

105. **English Literature of the Eighteenth Century.** Not given 1915-16. First semester: Dryden and Pope. Second semester: Swift and the Essayists. (3) Mr. BELDEN.

107. **Shakespeare.** Four or five selected plays; class-room reading and interpretation. (3) Mr. FAIRCHILD.

108. **Shakespeare.** Should be taken in conjunction with or after course 107. Devoted to the history of Shakespeare criticism and to the study of some of the formal elements of the plays (technique, language, versification, etc.). (2) Mr. FAIRCHILD.

109. **Tennyson and Browning.** Not given 1915-16. An intensive study of the poetry of Tennyson and Browning. Lectures and collateral reading in the literature of the Victorian period. (3) Mr. TISDEL.

110. **American Literature.** Alternates with course 105. (a) Sectional development; (b) growth of nationality; (c) present tendencies. The leading writers in prose and verse will be considered, first, as to their intrinsic worth; and second, as illustrative of national development. (3) Mr. BELDEN.

111. **The English Language.** An introductory course in linguistic study, taking first the present facts of the language, especially its vocabu-

lary, its relationships to other languages, its dialects, its spelling, and its pronunciation; and second, its past development through each period, with an introduction to Old English. (3) Mr. RAMSAY.

113a. **Chaucer and His Time.** A study of a considerable number of Chaucer's poems; reading of selections from other important authors of the fourteenth century; discussions of the chief types of Middle English literature. (3) Mr. RANKIN.

114. **Modern Prose Writers.** A study of the works of representative authors, with weekly reports and monthly essays. (3) Mr. MILLER.

115. **The English Novel.** A study of the development of the English novel, by means of lectures and the reading of a selected list of novels chosen to illustrate the development of the type. (3) Mr. BURROWES.

116b. **Debating.** This course naturally follows 127a. Investigation of special questions; practice in debate. Designed especially for members of the debating squad. (3) Mr. MCEUEN.

117. **Recent and Current English Literature.** A study of representative writers and literary movements of the last twenty-five years, grouped under two chief topics: Modern Drama and the Spirit of Home in Modern Literature. (3) Mr. RAMSAY.

118a. **English Versification.** (2) Mr. MILLER.

119. **Theories of Poetry.** Not given in 1915-16. Theories of poetry in general and the application of the principles of criticism to the different literary forms such as the lyric, the epic, and the drama. (2) Mr. FAIRCHILD.

120a and 120b. **Advanced Composition.** An informal course in practical composition open to a limited number of upperclassmen who make application in advance. (3) Mr. MILLER.

124. **From Spencer to Milton.** A study of the chief currents of English thought, as expressed in literature, during the period of transition from the Renaissance to the neo-classicists. The first semester will be devoted chiefly to the secular lyric (Donne, Cowley, Herrick), the second to religious poetry and the epic. Characteristic prose writers (Bacon, Browne, Milton, Hobbes, and the Platonists) will also be considered. (3) Mr. BELDEN.

125a. **Later Elizabethan Drama.** A study of the chief dramas produced by the later contemporaries and successors of Shakespeare down to the closing of the theaters in 1642. (3) Mr. RAMSAY.

126. **American Oratory.** A study of structure and style, with special reference to the expository address; collateral reading in oratorical literature; practice in writing and speaking. (2) Mr. TISDEL.

127a. **The Argumentative Address.** A study of the principles of argumentation; practice in the drawing of briefs and in the writing of forensics; debating. (3) Mr. MCEUEN.

150a. **The Foreign Debt of English Literature.** The purpose of this course is to give the student some acquaintance with the greater literary

masterpieces of the world and to indicate the nature and to some degree the extent of the influence which they have exerted upon English literature. (3) Mr. RANKIN.

206b. **Style and Usage.** An advanced course in the theory of English composition, involving the investigation of important questions of usage, structure, and style. (3) Mr. MILLER.

215. **Beowulf.** The study of the poem will be pursued as an exercise in Old English phonology, in text-criticism, and in the investigation of poetic principles. (3) Mr. BELDEN.

216. **Historical Grammar.** A selected series of topics in the history of the origins and development of the English language. (3) Mr. RAMSAY.

218b. **Middle English Literature.** A study of the language and the literature from the Norman Conquest to Chaucer, with emphasis on the metrical romances. (3) Mr. RANKIN.

219a or 219b. **Popular Ballads.** Not given 1915-16. A study of popular poetry on the basis of Child's *English and Scottish Popular Ballads*, with analysis of the theories of Gummere, Henderson, Meier, and others, and illustrations from balladry in Missouri. (2) Mr. BELDEN.

220. **Literary Criticism.** The history of critical theory will first be traced and the standard works read. This will be followed by more distinctly constructive work in which the problems of criticism will be considered and an attempt made to determine the grounds of literary judgment. (3) Mr. FAIRCHILD.

222. **The Rise of the Drama.** Not given 1915-16. From the beginnings of the modern drama in the church of the middle ages, through the English miracle plays, moralities, and interludes, and from the beginnings of the new dramatic impulse and the new types brought by the Renaissance during the sixteenth century, down to the Elizabethan Drama. (3) Mr. RAMSAY.

224. **Elizabethan Drama.** History of the earlier Elizabethan Drama; study of the works of Lyly, Kyd, Greene, Peele, and Marlowe; the doubtful plays of Shakespeare. (3) Mr. FAIRCHILD.

204. **Seminary.** Wordsworth. Hours and credit to be arranged. Mr. TISDEL.

GERMANIC LANGUAGES

104a and 104b. **Masterpieces in Modern German Drama, Lyrics, and Novel.** Intensive study, from the literary and cultural side, of a number of carefully chosen Modern German dramas, lyric poems, and novels. Parallel reading and reports. (3) Mr. ALMSTEDT.

105a. **Outline Course in German Literature.** The aim of the course is to acquaint the student with the most important works and movements in the evolution of German literary life. (3) Mr. HOFFMAN.

106b. **Lessing.** Lectures on Lessing's life and works; intensive study of Lessing, the dramatist and the critic; essays written in German. Course conducted in German. (3) Miss STEWART.

107. **Schiller.** This course will consist in the study of Schiller's *Jungfrau von Orleans*, *Maria Stuart*, *Braut von Messina*, *Wilhelm Tell*, *Wallenstein*; essays in German, based on the texts; lectures on Schiller's life and works. Course conducted in German. (3) Mr. HOFFMAN.

108. **Goethe.** Lectures on Goethe's life and works; intensive study of Goethe's prose, poetry, and dramas; essays written in German. Course conducted in German. (3) Mr. ALMSTEDT.

109b. **Outline Course in Historical Grammar.** This course together with course 105a is arranged to meet the needs of the prospective teacher of German. Though a knowledge of the older periods is desirable, it is not required. (3) Miss STEWART.

110b. **Advanced Composition and Conversation.** Advanced course in German theme-writing; discussions of grammatical, syntactical, and stylistic points. This course is intended for teachers of German or for students who propose to become teachers of German; conducted in German. (2) Mr. HOFFMAN.

111b. **Middle High German.** Introductory course. For advanced seniors. The class will study *Der Arme Heinrich* by Hartmann von Aue. Translation into modern German of medieval idiom. (3) Mr. ALMSTEDT.

212. **German Literature of the Second Half of the 19th Century.** This course will consist of lectures and reports. During the first semester Hebbel, Ludwig, Freytag, and Wagner will be especially emphasized. The minor authors will be treated in lectures. The second semester will be devoted to a study of the realistic writers of Germany, especially Hauptmann, Sudermann, Wildenbruch, and Fulda. The foreign influence on these writers will be carefully considered. (3) Mr. PRICE.

213b. **Romanticism.** This course is intended to comprise an exhaustive study, as far as is possible, of German romanticists and their works and to show the relation of this movement to similar ones in other literatures. (3) Mr. HOFFMAN.

214a. **The Reformation and Renaissance (1500-1750).** This course is to give the student a clear view of the development and decline of the literary tendencies, forms, and ideals of this period, and the influences that help to develop them or to accelerate their decline. (3) Mr. HOFFMAN.

215b. **Middle High German.** Walther von der Vogelweide. Discipline in phonology, morphology, syntax; comparison of medieval with modern idiom; a study in lyric poetry. (3) Mr. ALMSTEDT.

216b. **History of the Nibelungenlied.** This course is to comprise a study of the various theories as to the origin and authorship of the poem, the controversies in regard to it, and its relation to the Nibelungensaga

and other sagas. A reading knowledge of Middle High German is required. (3) Mr. HOFFMAN.

217b. **Old High German.** Prerequisite: course 220a. Phonology and forms; critical reading of Old High German texts. Texts: Braune, *Althochdeutsche Grammatik* and *Althochdeutsches Lesebuch*. (3) Mr. ALMSTEDT.

218a. **Old Norse.** Prerequisite: course 220a. Phonology and forms; critical reading of one or more sagas. Texts: Heusler, *Altisländisches Elementarbuch*; and Heusler, *Zwei Isländer-Geschichten*. (2) Mr. ALMSTEDT.

219b. **Old Saxon.** Phonology and forms; critical reading of the *Heliand*. A desirable antecedent: course 220a. (2) Mr. ALMSTEDT.

220a. **Gothic.** Phonology, morphology, and syntax; reading from *Ulfilas*; the relationship of Gothic to Indo-European and to later Germanic dialects; general introduction to the study of Germanic philology. (3) Mr. ALMSTEDT.

221. **Current Publications.** (1) Miss STEWART.

222. **Seminary.** Subject to be determined. For special students only. (2)

Any other courses in Germanic languages will be arranged if the needs of the students require.

ROMANCE LANGUAGES

FRENCH

101. **French Phonetics.** The organs of speech, sound formation, etc.; drill in French pronunciation. (1) Mr. MURRAY.

104. **Composition and Conversation.** Prerequisite: course 3. Translation into French of standard English; original themes; study of syntax, grammatical problems, style; conversation. (2) Mr. BROOKS.

106. **French Literature.** Prerequisite: course 3. A general outline of the various periods; lectures, reading of selected works, critical works, and reports; relation of French literature to other European literatures. (3) Mr. MURRAY.

107. **French Drama of the Seventeenth Century.** Prerequisite: course 106. The origin and development of classical French drama; its structure, significance, etc.; Corneille, Racine, Molière. (3) Mr. BROOKS.

110. **Voltaire and Rousseau.** Prerequisite: course 106. The lives and works of these two great writers of the eighteenth century will be studied, and the attempt made to estimate their influence at home and abroad. (3)

113. **The Romantic School.** Prerequisite: course 106. Its origin in the eighteenth century; foreign influences; the revolt against classicism: its causes and effects; the principal writers of the school. (3) Mr. MATHIEU.

115. **Recent and Current French Literature.** Prerequisite: course 106. Study of modern works from the point of view that some will one day become classics; sociological tendencies in the modern drama and novel; symbolists and decadents; the regionalistic movement in the novel; literary criticism as art or science; reading of significant works by Rostand, Richépin, Maeterlinck, Brioux, Bourget, Bazin, Loti, Anatole France, Verhaeren, Règnier, Brunetière, Jules Lemaître. Lectures, conferences, reports. (3) Mr. WARSHAW.

120. **The Language and Literature Down to the Sixteenth Century.** Prerequisite: course 106. (1) Mr. MURRAY.

121. **The Literature of the Sixteenth Century.** (2)

212. **Seminary in French Literature.** Detailed study of some literary movement or representative writer. (2), (3), or (4) Mr. MURRAY.

214. **General Introduction to Romance Philology.** (2) Mr. MURRAY.

215. **Old French.** Prerequisite: course 214. (2) Mr. MURRAY.

216. **Seminary in Romance Philology.** Provençal, Old Spanish, Old Italian. (2) Mr. CHERUBINI; Mr. MURRAY; Mr. WARSHAW.

ITALIAN

121. **Dante.** First semester: the forerunners of Dante; *L'Inferno*; second semester: *Il Purgatorio*; *Il Paradiso*. (3) Mr. CHERUBINI.

122a. **Petrarch and Boccaccio.** (2) Mr. CHERUBINI.

123b. **The Poets of the Rinascimento.** (2) Mr. CHERUBINI.

124. **Italian Literature of the Nineteenth Century.** (3) Mr. CHERUBINI.

125. **Composition and Conversation.** (2) Mr. CHERUBINI.

Italian Philology. See courses 214 and 216.

SPANISH

132. **The Spanish Drama.** The reading of representative plays, chiefly modern, by Echegaray, Núñez de Arce, Ayala, Galdos, Calderón; discussion of the spirit and technique of the Spanish drama; constant exercise in the practical use of the language will be afforded. (2) Mr. WARSHAW.

233. **Seminary in Spanish Literature.** Detailed study of some literary movement or representative writer. (2) Mr. WARSHAW.

Spanish Philology. See courses 214 and 216.

GROUP OF PHILOSOPHY AND EXPERIMENTAL PSYCHOLOGY

EXPERIMENTAL PSYCHOLOGY

These courses are open only to students who have had an introductory course in general psychology.

103a or b. **Graphology.** The manifestation of individual characteristics in peculiarities of script. Methods of identifying individual handwriting and of discovering forgeries. (3) Mr. MEYER.

104a or b. **General Esthetics.** An experimental as well as theoretical study of the psychological laws underlying our appreciation of the beautiful, chiefly in the arts of painting, sculpture, and architecture, and also in nature. No familiarity with the technique or history of art is required. The aim of this course is to develop in the student an independent judgment in questions concerning the beautiful. (3) Mr. MEYER.

105a or b. **Theory of Music.** The æsthetic laws of music. The psychological differences between primitive and highly developed music, and between European and exotic music. (3) Mr. MEYER.

106a or b. **Principles of Psychology.** Discussion of the general principles of scientific investigation. Application of these principles in the criticism of modern psychological theories and problems. (3) Mr. MEYER.

108a or b. **Abnormal Psychology.** The abnormalities of mental life resulting from inborn, pathological, or artificial causes (such as idiocy, aphasia, apraxia, somnambulism, hypnosis, etc.) and their educational, medical, and forensic significance. (2) Mr. MEYER.

109a or b. **Psychological Systems.** A comparative study of the psychological systems as found in the chief text-books on psychology issued during the last thirty years. (4) Mr. MEYER.

211a or b. **Psychological Seminary and Advanced Laboratory Work.** Critical reading of recent literature. Discussion of special problems and theories. Research work. Mr. MEYER.

PHILOSOPHY

103a. **Ethical Theory.** An introductory study of the main problems of ethics and of the chief methods of their solution, with constant reference to the principal historic schools for illustration and interpretation. The following topics will be included: the nature and method of ethics as a philosophical discipline; freedom; the ground of obligation; conscience; egoism and altruism; optimism and pessimism; hedonism; utilitarianism; intuitionism; self-realization. (3) Mr. HUDSON.

104a. **Ancient and Medieval Philosophy from the Ionian Schools to Bacon.** The work of the course will include a careful reading of the greater part of Plato's Republic. Lectures, required reading, oral and written reports. (3) Mr. HUDSON.

104b. **Modern Philosophy from the Renaissance to the 19th Century.** Lectures, class-room discussions, required reading, written reports. (3) Mr. SABINE.

105b. **Contemporary Tendencies in Metaphysics.** Open only to those who have had course 104b or its equivalent. A consideration of representative systems, issues, and controversies of the present day, together with their general relations to historic philosophy. Stress will be laid upon the problems and tendencies characteristically modern in

their setting, such as those aroused by the development of modern science. Lectures, required reading (including reference to the principal philosophic journals), reports, and conferences. (3) Mr. HUDSON.

109a. **Philosophy in the Life of the Nineteenth Century.** A non-technical presentation of philosophical ideas which have played a part in the social and political movements of the nineteenth century. Material will be drawn, as far as possible, from English literature. (3) Mr. SABINE.

110a. **Scientific Naturalism.** Prerequisite: course 104b or an equivalent. Materialism and other types of metaphysics that profess to depend in a special sense on the natural sciences; reading of Haeckel, Spencer, and others. (3) Mr. SABINE.

112b. **American Ideals.** A study of the ethical interpretations of life implied in American social and political institutions. (3) Mr. HUDSON.

230. **Seminary.** Subject to be determined. Two or three hours credit according to the amount of work done. Mr. SABINE; Mr. HUDSON.

GROUP OF EDUCATION

110a. **The Psychology of Learning.** Prerequisite: an approved course in general psychology and course 2a or its equivalent in educational psychology. An advanced course which undertakes to work out a science of education based upon a knowledge of the child and the laws of learning. Some of the topics considered are the development of attention, perception, and the various mental functions. Special attention will be given to the subjects of individual differences and the laws of learning as far as determined by the recent work in educational psychology. A part of the course will consist in a study of the period of adolescence. (3) Mr. PYLE.

111b. **Scientific Tests.** Prerequisite: course 2a or its equivalent. It is the purpose of this course to apply the results of psychological investigations to the problems of the school room in examining and testing methods of teaching, the classification and grading of pupils, the determination of individual types and capacities, and in ascertaining the characteristics of the learning process. Lectures and laboratory work. (3) Mr. PYLE.

112a. **The Abnormal Child.** A study of subnormal and supernormal children from the standpoint of genetic psychology. Examination of the causes of these deviations, tests for their determination, and a study of their proper treatment. (1) Mr. PYLE.

113a and 113b. **Current Problems.** A study of current problems in education from the point of view of psychology. Informal discussions and reports of periodical literature in educational psychology. The object of this course is to acquaint the student with present-day educational problems and give a basis and perspective for their scientific consideration. (1) Mr. PYLE.

120. **History of Education.** The purpose of this course is to give a better understanding and appreciation of present educational tendencies by tracing historically those educational movements which have been most effective in determining the present educational situation or are typical or prominent aspects of it. (2) Mr. COURSAULT.

121a. **Educational Classics.** An intensive study of the historical setting and content of a few educational classics which mark prominent movements in the development of educational thought and practice. (3) Mr. COURSAULT.

130a and 130b. **Theory of Teaching.** A general course which aims to formulate a method of class work and to illustrate, as fully as time will permit, its application to subjects in all grades of school work. (3) Mr. CHARTERS.

148. **Statistical Studies in Theory of Teaching.** Prerequisite: course 130a or its equivalent. The application of statistical methods to the improvement and testing of methods of teaching. (3) Mr. CHARTERS.

150a. **School Supervision.** A study in the principles of school supervision, in which emphasis is laid upon the relation between superintendent, supervisors, teachers, and pupils. Practical problems such as attendance, classification, government, reports, exhibits, will be briefly considered on the basis of this relation. The course consists largely of observational studies in the University schools. (2) Mr. MERIAM.

150b. **Supervision of Instruction.** A study in the principles and practice of class criticism, arranged for superintendents, principals, and supervisors in public schools and normal schools. Outlining studies, providing materials of instruction, helping pupils study, determining upon tests of efficiency, are the leading problems in the course. Laboratory work, supervising in the University schools, is a part of this course. (3) Mr. MERIAM.

151. **Elementary Education.** A study is made of the function of the elementary school in modern life and the nature of the curriculum needed to meet this aim. Elementary problems of school management and current methods of teaching reading, arithmetic, geography, etc., are studied. This course is planned for those preparing for special work in teaching or supervising in elementary schools and includes much observation and laboratory work in the University Elementary School. (1), (2), or (3) Mr. MERIAM.

160b. **School Economy.** A course in effective methods of school management from the standpoint of the teacher in secondary schools. (2) Mr. ELLIFF.

161b. **School Administration.** A general treatment of the important administrative problems of principals and superintendents in small city school systems, for which the class meets twice a week. The third hour of credit will be given for individual practice work in the investigation and solution of practical problems involved in the administration of the Uni-

versity High School, the University Elementary School, and the Columbia Public Schools. (2) or (3) Mr. ELLIFF.

163a. **High School Administration.** Prerequisite: courses 2a and 120 or equivalent. A consideration, from the standpoint of the administrator, of the main problems now confronting secondary education in the United States, with special reference to conditions in Missouri. The principal topics considered are: relation of high school to elementary school, college, and community; organization and direction of teaching staff; equipment; government; reorganization of curriculum with special attention to vocational training, physical education, and social life of high school; elimination of pupils; keeping, interpretation, and use of high school statistics; financing of secondary education. Open for credit only to superintendents, high school principals, and experienced high school teachers. (2) Mr. ELLIFF.

170b. **Principles of Education.** The purpose of this course is to reveal the fundamental principles upon which educational procedure should rest. Such topics as the following are considered: the relation of the individual to society; the ways in which the individual acquires ideas and ideals; the development of character and of knowledge and appreciation of the world; the values of the sciences, history, literature, etc.; the nature of social development; the fundamental ideas underlying the selection of the curriculum and methods of teaching; the relation of the various points of view from which education is studied. (3) Mr. COURSAULT.

180a and 180b. **Practice Teaching.** Hours and credit must be arranged with the instructor before registration. Application should be made in the semester preceding that in which this course is wanted. Mr. MERIAM.

210. **Seminary in Educational Psychology.** The special problems selected for study will depend upon the interest of those taking the course, the aim being to guide advanced students of education in constructive work in the theory of education through a detailed study of a few aspects of mental development. The course is open only to students who have had considerable training in both education and psychology. For thesis work. Credit to be arranged. Mr. HILL; Mr. PYLE.

211a and 211b. **Research Course in Educational Psychology.** Original investigation of problems in mental development or in any field of educational psychology. Open only to students who have had training in both general and educational psychology, including training in psychological method. Credit to be arranged. Mr. PYLE.

220. **Seminary in the History of Education.** A critical investigation of topics in connection with the thesis work for the graduate degrees. Mr. COURSAULT.

221b. **History of Education in the United States.** A research course for advanced students. (2) Mr. COURSAULT.

230. **Seminary in Theory of Teaching.** An intensive study of some problems in theory of teaching. The problems selected will depend in

part upon the interests of the students. Considerable use is made of psychology and history of education, satisfactory work in both being prerequisite to this course. (3) Mr. MERIAM; Mr. CHARTERS.

231. **Research Course in Theory of Teaching.** An intensive study of certain problems in theory of teaching, the selection of which is largely dependent upon the interest of the class. Primarily for students not in residence who are working upon special problems. Credit to be arranged. (3) Mr. CHARTERS.

250. **Seminary in School Supervision.** An intensive study of problems in connection with thesis work for graduate degrees. Opportunity is offered for experimental work in the University schools. Mr. MERIAM.

251. **The Public School Curriculum.** Research work on courses of study for elementary schools and for high schools. A close examination is made of typical curricula in schools of this country and foreign countries; also curricula of special schools. Study is made of the development of the curriculum to meet changing social and industrial conditions in community and national life and to comply more adequately with the psychological development of the pupil. (3) Mr. MERIAM.

260b. **Seminary in School Administration.** A research course in school organization and administration with special reference to city school systems. The course is to be taken only in connection with thesis work for the graduate degrees. Mr. ELLIFF; Mr. MERIAM.

270. **Seminary in Philosophy of Education.** An intensive study of philosophy of education made in connection with thesis work for the graduate degrees. Mr. COURSAULT.

271. **Philosophy of Education.** This course begins with a critical study of the origin and nature of some of the traditional fundamental beliefs that seriously affect the consideration of educational problems and leads to a systematic treatment of the fundamentals of education in the light of modern science and philosophy. The ideas acquired are then used in the interpretation and criticism of a variety of modern contributions to educational thought and practice. (3) Mr. COURSAULT.

In addition to the above, a number of courses in the teaching of Botany, English, German, etc., and in the administration of school subjects are offered and may be counted as education for the degree of Master of Arts.

For a statement of these courses, see the announcement of the School of Education in the general catalogue.

GROUP OF HISTORY AND POLITICAL SCIENCE

ECONOMICS

105a and 105b. **Money, Credit, and Banking.** A study of the relation of the production of the precious metals and the banking business to the supply of money and the prices of commodities. An inquiry is

also made into the organization and operation of the banking business in the leading nations with special reference to its bearing on loan and discount rates and the development of business. (5) Mr. STEWART.

106a or b. **Economics of Transportation.** A history of the development of transportation agencies, and a study of the principles of rate-making and rate-regulation. (3)

107b. **Economic History.** The American people in their advance from the simple economic life of colonial days to the complex activities of the present; the development of industry, commerce, transportation, finance, money and banking, and labor organization. The economic movements in other countries will be considered wherever they have had important influence on American development. (5) Mr. ARDZROONI.

108a or b. **Insurance.** The general principles, the different forms of personal and property insurance, and the main problems connected with each. (2) See Mathematics, course 155a or b.

109a or b. **Crises and Depressions.** The recurring periods of activity and inactivity in business known as prosperity, crisis, and depression. The causes and effects of these fluctuating movements are sought by an analytical study of recent business cycles. (2) Mr. STEWART.

110a or 110b. **Problems of Labor.** A study of the special problems and interests of wage-earners, such as the organization and policies of trades-unions, employers' associations, arbitration, profit-sharing, factory acts, and other forms of labor legislation. (3) to (5) Mr. ARDZROONI.

115a or b. **Public Revenues.** A critical examination of (1) the various theories as to the limits of state activity; (2) various ethical systems as related to the problem of justice in taxation; (3) proportional vs. progressive taxation; (4) the later developments in value theory as bearing on the more difficult problems of incidence; (5) the administrative aspects of income taxation; (6) ethical, legal, and constitutional aspects of franchise and corporation taxation; (7) the practicability of a scientific articulation of the various taxes under American conditions. (3) to (5) Mr. DAVENPORT.

117a or b. **Accounting.** The construction and interpretation of the accounts of the private business, the partnership, and the corporation. A study of the use of the income account and balance sheet in connection with the capitalization and valuations of property, and the relation of cost accounts to business and industrial efficiency. Laboratory work in bookkeeping. (3) to (5) Mr. COMER; Mr. SCOTT.

118a. **Corporation Finance.** Describes the purposes and methods pursued in the organization and management of business corporations and the uses and character of corporation securities as related to the investors and to the corporation's management. (2) Mr. VEBLEN.

119b. **Trusts and Combinations.** Treats of the development of business organizations, the financing of such enterprises, their relations to the control of industry, the prices of commodities, and the distribution of wealth. (3) to (5) Mr. VEBLEN.

120b. **Speculative Markets.** The organizations, methods, and functions of produce exchanges and securities markets and the influence of their operations upon the movement of prices. (2) or (3). Mr. STEWART.

121a or b. **Accounting and Business Policy.** A hasty survey of the genesis of the balance sheet, an intensive study of cost accounting, and the interpretation of the balance sheets of industrial corporations as pointing the way to sound business policy. (3) Mr. COMER; Mr. SCOTT.

211. **Advanced Economic Theory.** A critical examination of the writings of the leading economists from the time of Adam Smith to the present, to the end of constructing a correct theory of value and distribution. A survey of the theoretical aspects of the science. Credit to be arranged. Mr. DAVENPORT.

212. **Seminaries.** Credit to be arranged. Mr. DAVENPORT; Mr. STEWART; Mr. VEBLEN.

213a or b. **Statistics.** The rudiments of statistical methods based upon a study of sources and collection of statistical data, census reports, forms of averages and their proper uses, together with the graphic and tabular presentation of results. (3) See Mathematics, course 160b.

214. **History of Economics.** A first-hand study of authors and documents, with especial reference to the background of political and industrial conditions and of philosophical thought. The student is advised to correlate this course with related courses in philosophy, political science, history, and sociology. (2) or (5) Mr. VEBLEN.

219. **Economic Factors in Civilization.** An inquiry into institutions as affected by economic conditions with a view particularly to early European civilization. (2) to (5) Mr. VEBLEN.

232a or b. **Radical Economic Reforms.** A consideration of the essential features of the early nineteenth century radical economic thinking. An examination will be made of some of the writings of representatives of early socialistic thought—particularly of Karl Marx and leaders of French and German socialism. A study of the syndicalist movement both abroad and in the United States with special attention to recent radical tendencies in American politics. (3) Mr. ARDZROONI.

233a or b. **Valuation of Public Utilities.** A study of economic principles, legal precedents and administrative authorities, as bearing upon public valuation, for purposes of (a) taxation, (b) the fixation of rates and charges, (c) the terms of public appropriation. Collateral with course in engineering covering engineering theory and practice in the same field. (3) Mr. DAVENPORT.

HISTORY

100b. **Recent European History.** The political, social, and institutional history of the chief European countries since 1815 will be carefully studied with a view to present conditions. (5) Mr. KERNER.

115a. **Modern England.** A course dealing with the internal and external problems of England and the British Empire since 1660. (3) Mr. TRENHOLME.

120b. **English Constitutional History.** An advanced English history course dealing with the growth of English government and law as a background to present conditions in the British Empire and America. (3) Mr. TRENHOLME.

135a. **Oriental History (to 600 A. D.).** Political and social history of the early Oriental peoples of Assyria, Babylonia, Egypt, and Israel; Greece and Rome in their relations with the Orient. (3) Mr. OLMSTEAD.

135b. **Oriental History (600-1900).** A study of the political and social aspects of the rise of Islam with special emphasis on the relations between Western Asia and Europe. (3) Mr. WRENCH.

The two preceding courses, though they may be taken separately, together form a complete survey of the history of Western Asia.

140b. **American Social History.** A survey of the development of American society, with emphasis on the economic and social progress since the Revolution. (2) Mr. STEPHENS.

150a. **European Culture and Civilization—the Middle Ages.** A careful study of the blending of the Graeco-Roman, German, and Christian elements of culture during the early medieval periods, and a study of their development in the later medieval periods. (2) or (3) Mr. WRENCH.

160a. **The French Revolution and the Napoleonic Era.** Lectures, with discussion, based on text and collateral reading, on the political history of the period. (2) or (3) Mr. KERNER.

162b. **Slavic Europe.** A study of the political, economic, social, and cultural development of the Slavic peoples of Russia, Old Poland, Austria-Hungary, and the Balkans. (2) Mr. KERNER.

170b. **History of the West.** A study of the westward movement of population, the economic, social, and political development of the west, and the reaction of western ideals and influences on United States history. (3) Mr. VILES.

175a. **Recent United States History.** A course in the history of the United States since 1865, from the point of view of the historical background of present day problems. (3) Mr. VILES.

180b. **History of Missouri.** The primary aim of this course will be to give an account of the development of Missouri since 1803. (2) Mr. VILES.

185b. **The Crusades.** A course dealing in an intensive way with the crusading movement in both its western and eastern aspects. (2) or (3) Mr. WRENCH.

190a. **The Roman Revolution.** An advanced ancient history course consisting of a detailed study of the internal history of Rome during the years 133 to 31 B. C. (2) or (3) Mr. OLMSTEAD.

200. **Historiography and Historical Method.** A course of training for students intending to do advanced and graduate work in history. (1) or (2) Mr. TRENHOLME, assisted by the other members of the department.

210. **Seminary in Ancient History.** Rome and Carthage; the Punic Wars and their historians, Polybius and Livy. (2) or (3) Mr. OLMSTEAD.

230. **Seminary in American Political Government and History.** For the year 1915-16 the general topic for investigation will be the development of political parties, 1815 to 1840, with especial attention to the social and economic factors and to the political leaders. (2) or (3)

240. **Seminary in English Constitutional and Legal History.** A graduate research course in English constitutional and legal history. (3) Mr. TRENHOLME.

250. **Seminary in Historical Research and Thesis Work.** A course giving opportunity for research and thesis work along special lines. Primarily intended for candidates for graduate degrees. The work of the student will be under the direction of the instructor most interested in the field in which the topic of special research lies. (1), (2), (3), or (4)

POLITICAL SCIENCE AND PUBLIC LAW

103b. **Elements of Jurisprudence.** Not given in 1915-16. An introduction to the study of law. This course treats of the nature, sources, and classification of law and includes a consideration of the fundamental concepts of private law. The nature and use of legal authorities will be discussed. (2) Mr. LOEB.

104a. **European Governments.** A descriptive study of the constitutional organization and practical working of the principal governments of Europe, with considerable attention to political parties and current political questions. (3) Mr. SHEPARD.

105b. **Comparative Constitutional Law.** A comparative study of the legal and theoretical basis of the modern state, the various forms of government and the structure and function of the principal governmental organs. (3) Mr. SHEPARD.

106b. **Municipal Government.** A comparative study of the organization, functions, and administration of cities of Europe and the United States. During the latter part of the course special topics will be taken up in more detail, such as: central control over cities, municipal elections, municipal revenue, the regulation of public utilities, and municipal ownership. (2) Mr. LOEB.

107a. **Party Government.** A study of the theory, organization, methods of action and functions of political parties, with special emphasis upon the party-system of the United States. (2) Mr. SHEPARD.

201a. **Colonial Government.** A study of the present government and administration of the colonies of the United States and of other countries. (3) Mr. SHEPARD.

202a. **International Law.** Not given 1915-16. A general treatment of the law governing international relations in peace and war, with considerable attention to the development of arbitration and international organs of administration. (3) Mr. SHEPARD.

204. **Constitutional Law of the United States.** Particular attention will be given to the field of individual liberty defined in the Constitution of the United States and interpreted in the decisions of the Supreme Court. (3) Mr. LOEB.

208b. **The Government of Missouri.** Not given 1915-16. A study of the constitutional development of the state from the Louisiana Purchase to the present time, followed by a consideration of the organization and functions of the institutions of the central and local governments. (2) Mr. LOEB.

209b. **The Law of Taxation.** A study of the legal rules regulating taxation in the central and commonwealth governments of the United States. The student is advised to correlate this course with related courses in economics. (2) Mr. LOEB.

210. **History of Political Theories.** Not given 1915-16. A study of the development of political thought in its relation, as cause and effect, to political action, from the period of antiquity to our own day. (2) Mr. SHEPARD.

220. **Seminary.** Credit to be arranged. Mr. LOEB; Mr. SHEPARD.

SOCIOLOGY

110a. **Social Pathology.** A study of the origin, nature, and treatment of the dependent and defective classes. As causes of poverty and degeneracy are studied physical and mental abnormalities, the unequal distribution of wealth, low wages and standards of living, unemployment, etc. As remedial and preventive agencies are studied educational and legislative measures, social reform movements, eugenics, public and private relief, organized charity, almshouses and other institutions for dependents and defectives, etc. Text-book work and assigned reading and papers on special topics. (3) Mr. HANDMAN.

111b. **Criminology.** A study of the causes, nature, and treatment of crime; the principles of criminal anthropology and psychology, criminal jurisprudence, and penology. Among the topics treated are criminal statistics, the social causes of crime, criminality and degeneracy, female and juvenile criminality, the evolution of criminal law, the reform of criminal procedure, prison systems and the county jail, the industrial reformatory, the indeterminate sentence, prison labor, probation and parole, the treatment of the juvenile offender. Lectures and assigned reading. (3) Mr. HANDMAN.

112a. **Preventive Philanthropy.** An intensive study of some specific problems in preventive work, including a study of child problems, playgrounds, child labor, and the juvenile court. (2) Mr. HANDMAN.

115a and b. **Rural Sociology.** A study of social conditions in rural life. Among the topics considered will be the statistics and movements of rural population, the physical environment of rural life, isolation and means of communication, rural occupations, co-operative organizations among farmers, the family and woman's position in rural life, the country school, the country church, etc. The movements for the improvement of rural life will be considered. Lectures, assigned reading, and papers. (2) Mr. BERNARD.

116b. **Urban Sociology.** A study of social conditions in urban communities. The origin and growth of cities will be considered. An intensive study will be made of educational, political, moral, social, aesthetic, and religious forces and institutions in urban life. Municipal reform movements will be considered. Lectures, assigned reading, and papers. (2) Mr. HANDMAN.

125. **Anthropology and Ethnology.** A study of the origin and evolution of man as an animal and of the early stages in cultural evolution. Among the topics considered will be the prehistoric human types, the characteristics of the Negro, Mongolian, American, and Caucasian races, the beginnings of human culture, the stone and metal ages, the origins of the division of labor, language, magic, religion, moral ideas, science, art, and of social organization in the family, horde, clan, and tribe. Lectures and assigned reading. (3) Mr. ELLWOOD.

220a. **The Principles of Sociology.** A critical study of sociological theory. The sociological theories of recent writers, such as Tarde, Ross, Giddings, and Hobhouse, will be critically examined with a view to laying the foundations for a constructive theory of the social life in modern biology and psychology. Discussions and papers by the class. (3) Mr. ELLWOOD.

221b. **Biological Sociology.** A course on the biological basis of sociology. Among the topics treated will be the relation of organic to social evolution with special attention to heredity, selection, adaptation, and variation, the beginnings of social evolution in the animal world, and the instinctive, emotional, and intellectual forces for association. Lectures, assigned reading, and research work. (2)

222a. **Social Statistics.** Statistical methods for the investigation of problems in social science will be studied. The principal statistical investigations which have so far been made will be analyzed and one or more problems will be given to each student to furnish practice in quantitative treatment. Lectures, assigned reading, and research work. (2)

226. **Ethnic Psychology.** Not given in 1915-16. A study of the comparative psychology of races as shown in their customs, institutions, and social organization.

227a. **The Negro in America.** Not given in 1915-16. A study of the social, economic, moral, and educational conditions among the negroes of the United States. The work will consist of lectures, library work, and theses. Students will be admitted only after consultation. (3)

230b. **History of Social Philosophy.** Lectures on the development of social thought from Aristotle to the present. The social philosophies of Plato, Aristotle, St. Augustine, Thomas Aquinas, Machiavelli, Bodin, Hobbes, Locke, Vico, Montesquieu, Rousseau, Condorcet, and the sociological systems of Comte, Spencer, Shaeffle, Lilienfeldt, Gumpłowicz, Ratzenhofer, and Ward will, among others, be considered. A large amount of assigned reading will be required in this course. The student is advised to correlate this course with related courses in economics, history, political science, and philosophy. (3) Mr. ELLWOOD.

231a. **History of Philanthropy and the Poor Law.** A study of the development of legislation governing, and methods of administering public relief in England and America, and the parallel account of voluntary charitable institutions and methods. (2)

232a or b. **Radical Economic Reforms.** See Economics, course 232.

240. **Seminary.** Research work upon special problems in sociology and philanthropy. Two, three, or four hours' credit will be given according to the amount of work. Mr. ELLWOOD; Mr. BERNARD; Mr. HANDMAN.

GROUP OF MATHEMATICAL AND PHYSICAL SCIENCES

ASTRONOMY

105b. **Modern Astronomy.** A study of the problems and aims of modern astronomical science; its relation to other sciences. Frequent references to current literature of astronomy. (3) Mr. BAKER.

106a and b. **Advanced Astronomy.** Subjects are selected to meet the requirements of the individual students. Credit to be arranged. Mr. BAKER.

107a or b. **Advanced Practical Astronomy.** A continuation of course 102. Theory and use of astronomical instruments. Applications of the method of the least squares. (3) Mr. BAKER.

108. **Theoretical Astronomy.** Integration of equations of motion. Determination of parabolic and elliptic orbits; construction of ephemerides. Application to comets, planets, and binary stars. Credit to be arranged. Mr. BAKER.

209. **Astrophysics.** The application of physical principles to astronomy. Methods and results, with their bearing on solar and stellar phenomena. Studies in photometry and radial velocity. (3) Mr. BAKER.

210. **Stellar Photometry.** Theory and use of photometric apparatus. Investigation of stellar magnitudes and their variation, by visual and photographic methods. (3) Mr. BAKER.

220. **Research.** Opportunity for original investigation is offered to qualified students.

CHEMISTRY

111. **Organic Chemistry.** Lectures, recitations, and laboratory work. (3) Mr. CALVERT; Mr. BLACK; Mr. YANCEY.

112a. **Preparation of Organic Compounds.** A laboratory course in synthetic organic chemistry. May be taken with course 111. (2) or (3) Mr. CALVERT.

113b. **Preparation of Organic Compounds and Organic Analysis.** Laboratory course. (3), (4), or (5) Mr. CALVERT.

121. **Quantitative Chemical Analysis.** The general principles of gravimetric and volumetric analysis. Laboratory work and lectures. (3) Mr. GIBSON.

122a. **Technical Analysis.** Prerequisite: course 121. Gas, water, and fuel analysis. Required of chemical engineers. (3) Mr. GIBSON; Mr. HARTMAN.

123b. **Technical Analysis.** Prerequisite: course 121. The analysis of commercial products of an inorganic character. (3) Mr. GIBSON; Mr. HARTMAN.

125a. **Quantitative Organic Analysis.** Must be preceded or accompanied by course 121. Quantitative analysis of commercial organic products, such as alcohols, aldehydes, organic acids, glycerine, oils and fats, carbohydrates, petroleum products, soaps, etc. (3) Mr. CALVERT.

126b. **Quantitative Organic Analysis.** A continuation of course 125a. (3) Mr. CALVERT.

127. **Advanced Qualitative Analysis.** Prerequisite: course 27a or b. The complete qualitative analysis of rocks, minerals, slags, and alloys. (2) Mr. GIBSON.

131. **Physical Chemistry.** Prerequisite: course 111. Stoichiometry of gases, liquids, and solids; solutions and the theory of ionization; thermo-chemistry; the phase rule; chemical equilibrium. Lectures or recitations (two), laboratory (one), (two), or (three), according to amount of laboratory work elected. (3), (4), or (5) Mr. SCHLUNDT; Mr. HARTMAN.

133. **Electro-chemistry.** Prerequisite: course 111; Physics, course 3. Lectures, recitations, and laboratory work in electro-chemical measurements. Lectures (two); laboratory. According to amount of laboratory work elected (3), (4), or (5). Mr. HARTMAN.

135a or 135b. **Radioactivity.** Prerequisites: undergraduate courses in physics and chemistry. Lectures, recitations, and laboratory work on the radioactive types of matter and atomic disintegration. (3) Mr. SCHLUNDT.

141a. **Industrial Chemistry.** Prerequisite: course 27a or b, and 111, Organic Chemistry. Lectures and recitations on the application of chemistry to the purposes of human life as illustrated in the more important arts and industries having a chemical basis for their principal operations and processes. Fuels, water, acids, fertilizers, cements, glass, pottery, paints, gas, explosives, metals, alloys, etc. Additional credit may be obtained in this course by arranging for laboratory work. (3) Mr. BROWN.

142b. **Industrial Chemistry.** Prerequisite: same as for course 141a. Starch, glucose, sugar, fats, oils, soaps, dyes, and other industries. Lectures and recitations. (2) or (3) Mr. BROWN.

151a or 151b. **History of Chemistry.** Prerequisite: courses 11 and 131. May be taken along with course 131. (3)

200. **Chemistry of the Rare Earths.** Prerequisite: course 121. Lectures, recitations, and laboratory work on the occurrence, distribution, properties, and uses of the rare earths. (3) Mr. BROWN.

211a and 212b. **Advanced Organic Chemistry.** Prerequisite: course 111. Lectures on selected topics, supplemented by reading and reports on classical researches. (2) or (3) Mr. CALVERT.

221. **Advanced Quantitative Analysis.** Prerequisite: course 121. Chiefly laboratory work. The complete quantitative analysis of rocks, ores, minerals, slags, and various commercial materials and products. The work of the course will be varied to meet the needs of the individual. Credit to be arranged. Mr. GIBSON.

232a and 232b. **Advanced Physical Chemistry.** Prerequisite: courses 131 and 121. Lectures on selected topics, supplemented by reading and reports on classical researches. A reading knowledge of German and French is very desirable. Credit to be arranged. Mr. SCHLUNDT.

271. **Research.** Research is offered in this department in the following lines of work: inorganic, organic, physical, analytical, radio- and electro-chemistry, and micro-metallography. Arrangements for research work should be made by consultation with the instructor with whom the work is elected.

The University of Missouri Section of the American Chemical Society meets fortnightly for reports on current literature and researches in progress in the University. Students are invited to be present.

The students of the department conduct a chemical club which meets fortnightly.

GEOLOGY AND MINERALOGY

100a. **Economic Geology.** Prerequisite: course 1a or 1b or 2a or 2b; also course 108b or 106a if taken as graduate work. Deals with coal, oil and gas, clays, building stones, cement materials, gypsum, fertilizers, and various minor products. Their geographic distribution, mode of occurrence, uses, origin, and conservation are studied. The department has a good collection of these products which are studied in the laboratory. Field trips to mines and quarries near Columbia are made. (3) Mr. TARR.

101b. **Economic Geology.** Prerequisite: course 1a or 1b or 2a or 2b, and elementary chemistry; also courses 106a and 108b if taken as graduate work. Designed to give the student a general knowledge of the deposits of gold, silver, copper, iron, lead, zinc, aluminum, and minor metals. Their geographic distribution, mode of occurrence, origin, uses, production,

and conservation are studied. The department has good collections of ores from the larger mining camps, and these are studied in the laboratory.

(3) Mr. TARR.

102a. Advanced Physiography. Prerequisite: course 1a or 1b or 2a or 2b. A lecture, text-book, and conference course intended for those who wish to do advanced work in geology and for those who expect to teach physiography in secondary schools. The method will be topical and considerable reading will be required. (3-5) Mr. PARKINS.

103b. Historical Geology. Prerequisite: course 1a or 1b. Considers briefly hypotheses for the origin of the earth and, more fully, principles of sedimentation, distribution and kinds of rocks of each geologic period, geographic changes of the North American continent and causes for geographic changes, and incidentally the climate and life of each period. Several field trips are made for the study of the strata in northern Missouri. (3) Mr. BRANSON.

104a. Geologic Life Development. Prerequisite: course 5b or 1a or 1b and a course in zoology. Considers the changes that have taken place in the life of the earth from its first appearance to the present and the causes for these changes. The life of each geologic period is considered as a whole and in its relation to the life of the preceding and following periods. In the laboratory, students examine specimens that illustrate the gradual evolution toward living types. (3) Mr. BRANSON.

105. Field Course. Prerequisite: 5 hours of geology. Offered in the summer session. Intended as preparatory for advanced work in geology and as a basis for the teaching of geology and physical geography. The field work will consist of mapping the areal geology, describing the sedimentary formations, igneous and metamorphic rocks, collecting in a systematic way from the formations, and reporting on the structural geology, physiography, and economic products of a small area in central Colorado. A more general study will be made of a large area in Colorado. Special topics are assigned to graduate students, and this work may form the basis for masters' or doctors' theses. (8) Mr. TARR.

106a. Mineralogy. Prerequisite: course 1a or 1b or 2a or 2b. A study of the elements of crystallography, based upon lectures and work with models and crystals. This is followed by lectures on the physical and chemical properties of minerals with detailed descriptions of their mode of occurrence, geographic distribution, and origin. The laboratory work is designed to give the student the methods of determinative mineralogy. After a few weeks preliminary preparation with the elements, unknown minerals are given the student for determination. The student is expected to become familiar with about 200 common minerals. (5) Mr. TARR.

107b. Petrology. Prerequisite: courses 108b, 106a; inorganic chemistry; and general physics. The principles of optics, as applied to the polarizing microscope, and the optical properties of the rock forming

minerals are first studied. This is followed by microscopic and megascopic study of the various rock groups. (5) Mr. TARR.

108b. Rocks and Rock Minerals. Prerequisite: course 1a or 1b or 2a or 2b. A study of the various kinds of common rocks and of the minerals that constitute them. A field classification is followed in the laboratory and the methods pursued are those which would be used in the field. The lectures deal with the origin, geologic features, economic properties, and weathering of rocks. The course is designed for all those who wish a general knowledge of rocks as well as for geologists, engineers, architects, agriculturists, etc. (3) Mr. TARR.

109a. Geographic Literature. Prerequisite: course 1a or 1b and 6a. A reading course for students capable of doing semi-independent work. Reading may be along several lines, pedagogical, regional, economic, historical. Written reports required. (3-5) Mr. PARKINS.

200a. Principles of Ore Deposits. Prerequisite: courses 108b, 106a, 100a, and 101b; Chemistry, course 6a; and general physics. A consideration of the origin of the deposits of the metals and non-metallic minerals, the principles and chemistry of their deposition, and their metamorphism. (3 or 4) Mr. TARR.

202a. Stratigraphic Geology. Prerequisite: courses 103b and 104a. Lectures, map work, and field work on the stratigraphy of North America, with more intensive study of a limited area. (5) Mr. BRANSON.

203b. Paleontology. Prerequisite: course 104a. Zoology of invertebrates and comparative anatomy of vertebrates are desirable antecedents. A somewhat detailed study of a few of the main groups of invertebrates or vertebrates with reference to their evolution and distribution previous to the present period. The content of the course will be varied to suit the needs of individual students. (5) Mr. BRANSON.

204. Seminary. Geological literature and history. (1-2) Mr. BRANSON; Mr. TARR.

205. Research Work. Offered by members of the department in their respective lines.

MATHEMATICS

It is especially recommended that students intending to specialize in mathematics should take courses in French and German in the preliminary work; but an extensive knowledge of the literature of those languages is not necessary.

The courses past course 100 are open only to those who have secured the permission of the instructor in the course.

100. Second Course in Calculus. This course should be elected by all who have reasonably succeeded in elementary calculus, who desire to continue mathematical work. It will deal with questions necessarily omitted or treated hurriedly in the first course on calculus and will cover approximately the ground indicated by Goursat-Hedrick, Course in Math-

ematical Analysis, including also introductory lectures on sets of points.
(3) Mr. AMES.

110a and 115b. **The Historical Development of Mathematics.** Designed as an introduction to higher courses in mathematics, and as a comprehensive view of the whole subject for students who will not pursue mathematics farther. It will consider the main problems, the point of view, and the methods of the principal higher divisions of mathematics, together with an intensive study of typical topics selected from a wide range. The treatment of any topic will be accompanied by a consideration of the larger significant facts in the history of its development. While the two courses, 110a and 115b, form essentially one course, the latter is so arranged that it may, by special permission, be elected independently of course 110a by suitably prepared students. (3) Mr. AMES.

120a and 125b. **Differential Equations and Their Applications.** A short time will be spent in the consideration of differential equations and in the formal solution of some of the simpler types. This will be followed by the careful study and solution of certain problems of geometry, physics, and other sciences in which differential equations occur. Course 125b is so arranged that it may, by special permission, be elected independently of course 120a by specially prepared students. (3) Mr. HEDRICK.

150. **Graphical Analysis.** Graphical computations, such as construction of rational functions, solution of differential equations, construction of graphical tables, and a treatment of certain topics of analysis. (1) Mr. KELLOGG.

155a or b. **Mathematics of Business and Insurance.** Prerequisite: course 8 or its equivalent advised. The fundamental methods and computations involved in annuities, depreciation, sinking funds, stock and bond calculations; special attention to the theoretical and mathematical aspects of the different phases of insurance. (3) Mr. WESTFALL.

160a or b. **Probabilities and Statistics.** Fundamental elementary topics in the theory of probabilities, including the theory of least squares, statistical methods, applications and illustrations from social and biological sciences, with assignment of special problems to suit the need of the student. (3) Mr. WESTFALL.

200a or b. **Seminary.** The members of the staff will conduct work in reading and research in private with students prepared for such work. The nature and amount of the work done may vary materially. The course may be elected repeatedly in different semesters for different work and for any number of hours sanctioned by the instructor.

205a or b. **Modern Algebra.** The nature of the course is best indicated by such reference books as Weber's Algebra and Bocher's Higher Algebra. (3) Mr. DUNKEL.

210a or b. **Differential Geometry.** Naturally follows either course 100 or 115b. Introduction to the theory of modern differential

geometry. Reference books: Eisenhart; Joachimstahl; Wilczynski; Bianchi. (3) Mr. INGOLD.

215a or b. **Projective Geometry.** Lectures, supplemented by reading. Reference books: Emch; Veblen and Young; Reye; Scott. (3) Mr. INGOLD.

220a or b. **Fourier's Series and Allied Series.** Introduction to mathematical physics. Lectures, supplemented by reading. (3) Mr. KELLOGG.

225a or b. **Potential Function.** Continuation of course 220a. Properties of potential functions; boundary value problems; and applications. Lectures, supplemented by reading. (3) Mr. KELLOGG.

230. **Theory of Functions of Real Variables.** Higher Analysis, including the most important features of mathematical analysis, in a comprehensive but elementary manner. Lectures, supplemented by reading. (3)

240. **Theory of Functions of Complex Variables.** Alternate years. Not given 1915-16. Theories of Riemann, Cauchy, and Weierstrass, in their elementary phases. Theory of functions of a complex variable; elliptic functions. (3) Mr. HEDRICK.

251a or b. **Seminary in Actuarial Science.** Advanced investigations in actuarial and allied problems. Hours to be arranged. Mr. WESTFALL.

260a or b. **Theory of Groups, with Application to Galois' Theory and Lie's Theory.** Lectures. (3)

280a or b. **Calculus of Variations.** Theory of maxima and minima for functions defined on a general range. Emphasis is laid on the applications. References to Hadamard, Bolza, and other treatises. (3)

The following courses are offered occasionally, when the needs of the student seem to warrant:

235. **General Theory of Functions.** (3)

255a or b. **Theory of Differential Equations.** (3)

265a or b. **Theory of Numbers.** (3)

270a or b. **Analytical Mechanics.** (3)

275a or b. **Partial Differential Equations of Mathematical Physics.** (3)

Mathematical Clubs. The students of the department conduct, for the discussion of mathematical topics, a club, to which all persons interested are eligible. The members of the staff of the department hold regular meetings for the discussion of current literature and of recent research, which are open also to qualified graduate students.

For other courses on mathematical topics, see also the announcements of Physics and of the School of Engineering.

PHYSICS

Students intending to specialize in physics should also take mathematics. Even in the less mathematical courses some knowledge of calculus is of great advantage.

104a. Electrical Measurements. Two lectures and three laboratory periods. In the lectures is given an introduction to the mathematical theory of electricity and electrical measurements. The laboratory work consists of such work as comparisons of resistances by Kelvin double bridge and Carey Foster methods; determination of temperature coefficients; comparison of electromotive forces of cells; various uses of the potentiometer; comparison and absolute measurement of capacities; measurement of the coefficient of self and mutual induction; calibration of ammeters and voltmeters; photometric work with incandescent lamps. (3), (4), or (5) Mr. RENTSCHLER.

106a and 106b. Mechanics and Heat. Laboratory work similar to that given in course 108. Standard experiments in angular motion, acceleration of gravity, conservation of momentum, moment of inertia, elasticity, efficiency of machines, etc. Experiments in heat will involve a study of such things as specific heats of solids and liquids, heats of combustion, vapor densities, the simpler laws of radiation, and different methods of measuring high and low temperatures. Work in either mechanics or heat may be selected to meet the individual needs of the student. (1), (2), or (3) Mr. REESE.

108a and 108b. Electricity and Light. This course is entirely laboratory work and must be preceded by either course 1 or 3. It offers training in the more exact methods of laboratory measurements. The work is entirely individual so that the time may be spent either on optical or electrical problems. In light the work is quantitative, consisting of measurements of wave lengths by interference methods, Fresnel mirrors, interferometers, etc.; determinations of refractive indices; study of resolving power of optical instruments and similar problems. In electricity the work is the same as the laboratory work of course 104a. (1), (2), or (3) Mr. REESE; Mr. RENTSCHLER.

109. Advanced Work in General Physics. This course, largely laboratory work, will be adapted to meet the needs and attainments of individual students. A student may be assigned a definite problem, the literature of which must be studied and the experimental work performed with the care of original research. (2), (3), or (4) Mr. STEWART; Mr. REESE.

110b. Electricity and Magnetism. This course is not mathematical in the same sense as courses 205-221; still it contains some theoretical work. Students desiring laboratory work in connection with this course can elect one or two hours of course 108. Lectures and recitations. (3) Mr. RENTSCHLER.

112a. Heat. (3)

112b. Light. (3)

These courses are open to those who have completed course 3 or 4 or the equivalent. Recommended to those who either intend to teach in high schools or desire work more general in character and less mathematical than courses 205, 206, 207, and 215. The work is largely descriptive but contains some theoretical work in which an elementary knowledge of calculus is desirable though not essential. The course in heat includes some thermodynamics, one of the fundamental branches of physics. Students desiring laboratory work in connection with these courses may elect one or two hours from course 108 or 106. (3) Mr. DIKE.

117b. Spectroscopy. Open to those who have had course 1 or 3. A practical course in the use of various forms of spectroscopes and the applications to physical problems. (2) Mr. REESE.

121b. Electrical Waves. Theory and applications. (2) Mr. STEWART.

Courses 205, 206, 207, and 215 are courses in mathematical physics.

205. Theory of Light. Based on Drude's Theory of Optics. Special attention is given to the electromagnetic theory. Lectures and recitations. (3) Mr. STEWART.

207. Theory of Electricity and Magnetism. Lectures and recitations. (3) Mr. STEWART.

Courses 205 and 207 will not both be given in the same year.

206. Thermodynamics. Lectures on the classical thermodynamics with its application to the theory of heat radiation and certain branches of physical chemistry and electricity. The more modern views, based on atomic theories, are also taken up, and the student is introduced to statistical mechanics. Differential and integral calculus are prerequisite, and an understanding of the more general principles of mechanics is desirable. (3) Mr. REESE.

215. Dynamics. Introduction to the fundamental principles of mathematical physics. (3) Mr. REESE.

209. Electron Theory. Lectures and assigned readings. (3)

210. Seminary. Critical reading and discussion of current research work in physics. A colloquium in which all members of the teaching staff of the department and students of sufficient attainments take part. (1)

211. Research Work. Hours to be arranged. Mr. STEWART; Mr. REESE; Mr. RENTSCHLER.

225a and 225b. Recent Developments in Experimental Physics. Lectures and demonstrations. (1) or (2) Mr. RENTSCHLER.

226. Recent Developments in Theoretical Physics. Lectures and assigned readings. (2) Mr. REESE.

GROUP OF BIOLOGICAL SCIENCES

ANATOMY

105a. **Topographic Anatomy.** A study of the topography of the various organs by means of serial sections through the body. Open only to students who have completed the undergraduate courses in anatomy. Laboratory. (2) Mr. JOHNSON.

206. **Advanced Anatomy.** Elective. Prerequisite: course 102a, 103b, or 104b. Advanced work will be given in any of the special fields of anatomy, the amount and character of which will be varied to suit individual needs. Mr. CLARK; Mr. JOHNSON.

207. **Research.** Problems of original investigation will be assigned in anatomy, histology, or embryology. A reading knowledge of French and German is required. Hours to be arranged. Mr. CLARK; Mr. JOHNSON.

BOTANY

100a. **Plant Physiology.** Lectures and laboratory work on the physiology of the common cultivated plants, covering such topics as absorption, transpiration, synthesis of carbohydrates and proteins, digestion, translocation, respiration, growth, reproduction, and the reaction of plants to stimuli. (5) Mr. LEWIS; Miss KEENE.

101b. **Plant Ecology.** Prerequisite: course 100a; must be preceded by or taken with course 14b. A study of the relation of plants to their environment, including a discussion of the origin, development, structure and succession of plant formations. (2) Mr. LEWIS.

102a. **Plant Pathology.** Prerequisite: course 3a. A study of the life histories of important parasitic fungi and their pathological effects upon the host; isolation of parasites, technique of culture methods, and inoculation of the host. (3) Mr. REED.

103b. **Soil Bacteriology.** Prerequisite: course 3a. Deals with the relation of micro-organisms to soil problems. Nitrogen fixation, nitrification, denitrification, and the effect of various factors on the number and kinds of organisms in the soil are considered. (3)

104a. **Histological Methods.** The student will learn the methods used in the preparation and preservation of class material in bulk, and in fixing, sectioning, and staining of sections for microscopical study. (2) Mr. DURAND.

105. **Comparative Morphology and Embryology.** Prerequisite: should be preceded or accompanied by courses 104a, 107b. A detailed study of the structure and life history of selected representatives of the great groups of green plants. Special attention will be given to tracing the development and homologies of sterile, sporogenous, and reproductive parts—such as the formation of spores and gametes, fertiliza-

tion, the development of the embryo, etc. The nuclear changes accompanying fertilization and sporogenesis will be followed. (3) Mr. DURAND.

106b. **Principles of Plant Breeding.** A discussion of the fundamental principles of plant breeding, including parthenogenesis, hybridization, Mendelian phenomena, etc. Lectures and reports on assigned readings. (3) Mr. REED.

107b. **Cytology.** Prerequisite: course 104a. Lectures and laboratory work on the cell as the unit of structure and the physical basis of heredity. (3) Mr. LEWIS.

108b. **Diseases of Forest Trees.** Prerequisite: course 102a. The course takes up a study of the fungous diseases of forest trees, the fungi which cause decay in timber and the methods of timber treatment. (3) Miss KEENE.

109b. **Diseases of Horticultural Plants.** Prerequisite: course 102a. The life histories, pathological effects, and control of the fungi causing disease in vegetables and orchard trees. (2) Mr. REED.

110a. **Principles and Methods of Disease Control.** This course must be preceded or accompanied by course 102a. A study of fungicides in their relation to host and parasite, their composition, preparation, and methods of application; other methods of disease control, including the development of disease resistant plants. (2) Mr. REED.

200. **Seminary.** Special subjects of botanical work will be taken up and discussed, including the results of investigations carried out in the department. A reading knowledge of French and German is essential. (1) Mr. REED.

201. **Research.** Students who have had adequate preparation will be assigned some special problem for investigation. A reading knowledge of French and German is essential. Credit and hours to be arranged. Mr. DURAND; Mr. LEWIS; Mr. REED.

PATHOLOGY

201a and 201b. **Advanced Pathology.** The amount and character of the work will depend upon the needs and qualifications of the student. In connection, opportunity will be afforded for practical experience in the handling of all kinds of morbid material. Hours to be arranged. Mr. DOLLEY; Mr. MARTIN.

202. **Research.** Opportunity is offered to students sufficiently prepared for original investigation of unsolved problems in the fields of pathology and pathological physiology. A reading knowledge of German is required and French is recommended. A seminary is held once a week. Mr. DOLLEY.

203. **Normal and Abnormal Neurocytology.** The application of the general principles and theories of biology to the nerve cell in health and disease. The work will necessarily consist largely of original inves-

tigation and will be adjusted to the training of the student. Hours to be arranged. Mr. DOLLEY.

204a. **Pathological Physiology.** An experimental course. (2) Mr. DOLLEY; Mr. MARTIN.

PHYSIOLOGY

101a. **General Physiological Chemistry.** Prerequisite: Chemistry, course 111. Physiological chemistry of the carbohydrates, fats, and proteins; of the cell and special tissues; of the blood; of respiration; of metabolism; of secretions and excretions; and a quantitative study of the urine in relation to diet. (4) Mr. GULICK; Mr. CARTER.

102a. **Physiology of Secretion, Metabolism, and Reproduction.** The physiology of secretory processes, digestive mechanics, absorption, excretion, respiration, metabolism and energy exchange, heat regulation, and reproduction. (2) Mr. KRUSE; Mr. SUMMERS.

103a. **Experimental Physiology.** The physiology of circulation, respiration, muscle and nerve, nervous system, and sense organs. (6) Mr. GREENE; Mr. KRUSE.

104a and 104b. **Advanced Physiological Chemistry.** A course supplementing and extending course 101a. The preparation and chemistry of the proteins; a qualitative and quantitative study of the tissues and secretions, of enzymes, of putrefaction and putrefactive products; analyses of typical foods; and the detection of food preservatives and adulterants. The prosecution of a short investigation and formal report on the same are required. (2-4) Mr. GULICK.

105b. **Pharmacology.** Presents the physiological action of drugs from the experimental point of view. The demonstrations are made on man and the lower animals. (4) Mr. GREENE; Mr. KRUSE.

107b. **Toxicology.** Prerequisite: course 104a or 105b. (2 to 3) Mr. GULICK.

206a. **The Physiology of the Nervous System.** (3) Mr. GREENE.

208. **Journal Club.** (1) Mr. GREENE.

209a. **The Physiology and Pharmacology of the Circulatory System.** (3) Mr. GREENE.

210a and 210b. **Advanced Physiology.** Advanced courses in physiology, physiological chemistry, and pharmacology. Individual problems will be assigned to students of sufficient preparation. Hours to be arranged. Mr. GREENE; Mr. GULICK.

211. **Investigation.** Opportunity is offered for research into questions of current physiological interest. Mr. GREENE; Mr. GULICK.

PREVENTIVE MEDICINE AND BACTERIOLOGY

102a. **Pathological Bacteriology.** Prerequisite: Botany, course, 3a or 3b. Subjects studied include: relation of bacteria to disease; the fundamental principles of immunity, serum diagnosis, serum and vaccine

therapy. The different diseases are discussed, and the micro-organisms causing them are studied in the laboratory, with animal inoculations and demonstrations. The course includes also the study of the best known diseases caused by protozoa. (4) Mr. RAVENEL; Mr. DUPRAY.

201a and b. **Advanced Bacteriology.** Prerequisite: course 102a. Amount and character of work will depend on needs and qualifications of student. The manufacture of autogenous vaccines, the determination of the opsonic index, making and use of various sera, and the study of milk and water are among the subjects suggested. Hours to be arranged. Mr. RAVENEL; Mr. DUPRAY.

202. **Research.** Prerequisite: course 102a. Students who are sufficiently prepared will be given problems requiring original investigation in the fields of bacteriology and public health. A reading knowledge of French and German recommended. Hours to be arranged. Mr. RAVENEL; Mr. DUPRAY.

203. **Conduct of Public Health Laboratories.** Prerequisite: courses 102a and 201a. Designed for those who expect to take up such work as a profession or for teaching purposes. Graduates in medicine preferred. The collection and shipment of various specimens, their examination, milk and water problems, etc., will be discussed and the practical work carried out in the laboratory. Hours to be arranged. Mr. RAVENEL; Mr. DUPRAY.

ZOOLOGY

100a. **Embryology of Vertebrates.** Designed to lay the foundation of vertebrate embryology. Successive stages in the development of the frog, the chick, and the pig are studied from preparations of entire embryos and from serial sections. These observations are used as a basis of comparison for the study of human embryology. (3) Mr. LEFEVRE; Mr. TANNREUTHER.

101b. **Comparative Embryology of Invertebrates.** A comparative study of the development of representative forms from the principal phyla of the invertebrates, including a consideration of general phylogenetic and morphological problems. (3) Mr. CURTIS.

102b. **Cytology.** A study of the cell, with special reference to problems of development and inheritance. Cytological technique. (5) Mr. LEFEVRE.

103a. **Animal Ecology.** A study of animals in relation to their environment. (3) Mr. DODDS.

104a. **Genetics and Evolution.** Experimental study of genetics and its relation to the problems of evolution. Emphasis is laid on the phenomena of Mendelian inheritance and the cellular mechanism of heredity. (2) Mr. LEFEVRE.

200. **Research.** The investigation of unsolved problems of zoology, in which the student is trained in the exercise of original observation and

thought. A reading knowledge of French and German is essential. Hours to be arranged in accordance with the requirements of individual students.

201. **Seminary.** Meetings at which subjects of zoological investigation are discussed by instructors and students. Each student is required to give at least four lectures during the year, and experience is thus gained in presenting, in the form of lectures, the results of reading and research. A reading knowledge of French and German is essential. (1)

HISTORY OF ART

111. **History of Renaissance Painting.** Should be preceded or accompanied by European History (History, course 1a). With Italian Painting, European Culture and Civilization (History, course 150a) is also earnestly recommended. First semester: Italian Painting. Second semester: Painting of the Netherlands and of Germany. (3) Mr. PICKARD.

113. **Masterpieces of Architecture, Sculpture, and Painting of Classical, Renaissance, and Modern Times.** Lectures fully illustrated with the stereopticon. Aims to show the historical development of art by the discussion of some of the finest examples in each of the three divisions mentioned. (1) Mr. PICKARD.

216. **Seminary in the History of Art.** Hours and work to be assigned. Mr. PICKARD.

As supplementary to all courses offered in the history of painting and of sculpture, Introduction to Art (Theory and Practice of Art) is recommended.

For courses in Classical Archaeology and Art, see page 9.

THEORY AND PRACTICE OF ART

103. **Theory of Design.** Prerequisite: course 2a or 2b or its equivalent. The study of design as an art activity fundamental to the fine arts and crafts and a basis for art criticism. The problems of pure design; the relation of the art product to its environment; the relation of the aesthetic to other factors in the work of art; the application of the principles of design to definite problems. Two lectures and one laboratory period a week. (3) Mr. ANKENY; Mr. CARR.

105. **Pictorial Composition.** Prerequisite: course 4 or courses 2a or 2b and 103. Exception may be made to students possessing technique of photography. Study and practice in the making of pictures. (2) Mr. CARR.

106. **Painting.** Prerequisite: course 4, while course 103 is advised in addition. Style, theory, and methods of various schools and movements. Lectures, study of examples, and reading. Experimental practice in painting from still life and life, with work in original composition. (3) Mr. ANKENY.

107. **Tone.** An advanced painting course. A close analysis of the composition and relation of tones (value, color quality, intensity), with the equivalents in pigments in interpreting both indoor and outdoor subjects. Two periods a week will be given to work directly under the instructor, in addition to which the student will be expected to paint a great deal alone, bringing in the work for criticism. (3-5) Mr. ANKENY.

108. **Life.** An advanced drawing course. Drawing and modeling the figure from life. (3-5) Mr. ANKENY.

208. **Seminary.** A research course in the processes of the Old Masters with the adaptation of their traditions to modern work. Mr. ANKENY.

AGRICULTURE

AGRICULTURAL CHEMISTRY

101a and b. **Advanced Agricultural Chemistry.** A continuation of the regular undergraduate course in agricultural chemistry, which is required of all undergraduate students in agriculture. A critical study of methods in use in the chemical laboratories of the experiment station will be made, including an examination of foods and feeding stuffs for adulteration, etc. Three to five periods per week, including one lecture or recitation each week. Hours to be arranged. Mr. TROWBRIDGE; Mr. MOULTON; Mr. HAIGH.

201a and b. **Seminary.** (1) Mr. TROWBRIDGE.

202a and b. **Research.** Can be elected either as major or minor for advanced degrees, and may include a thesis showing the results of the investigations. The chemical laboratories offer exceptional facilities for research. Subjects may be selected in (a) animal nutrition; (b) composition of animal fats as affected by feeding, age, breed, etc.; (c) the composition of meats, feeding stuffs, fertilizers, soils, etc.; (d) the chemical problems involved in the dairy industries; (e) the distribution of phosphorus in the animal organism with special reference to the separation of phosphorous compounds; (f) chemical problems involved in the enforcement of state and national pure food laws; (g) the separation of the proteins of flesh and study of their hydrolytic cleavage products. (3-5) Mr. TROWBRIDGE; Mr. MOULTON; Mr. PALMER; Mr. HAIGH.

203a. **Chemistry of the Proteins.** A critical study of the composition and classification and of the decomposition products of the meat and vegetable proteins. Lectures and recitations. (3) Mr. TROWBRIDGE.

204a. **Physiological Chemistry of the Domestic Animal.** Designed to meet the requirements of students fitting themselves for investigations in animal nutrition. (3) Mr. PALMER.

ANIMAL HUSBANDRY

200. **Seminary.** Special investigation bearing on selected lines in animal husbandry. The preparation and presentation of papers for discussion by the class. (2) Mr. MUMFORD; Mr. TROWBRIDGE; Mr. ALLISON.

201. **Experimental Feeding.** Original investigations of important problems in feeding cattle, sheep, and swine. This course is intended to give experience in methods of experimental work and to make the student familiar with the most approved methods of investigation. Mr. TROWBRIDGE; Mr. ALLISON.

202. **Research in Animal Husbandry.** Advanced studies of special phases of animal production. Recommended to students who desire more thorough training in the production of cattle, horses, sheep, or swine, or who may wish to make a more careful study of the fundamental principles of animal husbandry. Mr. MUMFORD; Mr. TROWBRIDGE; Mr. ALLISON.

203. **Animal Breeding.** Research in special subjects bearing on the inheritance and development of characters in the domestic animals. Mr. MUMFORD.

204. **Zoometry.** Special investigation of the relations of form and function in the domestic animals. Mr. TROWBRIDGE.

205. **Research in Stock Farm Management.** Investigations of the principles governing successful systems of stock farm management. Special studies of highly efficient stock farms. Mr. MUMFORD; Mr. TROWBRIDGE; Mr. ALLISON.

DAIRY HUSBANDRY

100b. **Milk Production.** The breeds of dairy cattle; selection, breeding, and development of a dairy herd; care and management of dairy cattle; feeding for milk production; production of certified and market milk; milk for butter-making and cheese-making; utilization of by-products of the dairy. Mr. ECKLES.

201. **Seminary.** The object of this course is to train the student to do independent work and to develop the spirit of research. It consists of special investigation and study along selected lines of research with review and discussions of recent work. Each student presents papers on selected topics and reports on recent scientific investigations and on current literature of the subject. Mr. ECKLES.

202. **Research in Dairy Husbandry.** A large herd of highly developed dairy cattle representing four breeds makes it possible to offer facilities for study and investigation of a variety of subjects pertaining to milk production and the care and management of dairy cattle. Students interested in this line are allowed to carry out certain experiments with the dairy animals and in some cases to assist in lines of investigation under way in the Agricultural Experiment Station. Mr. ECKLES.

203. **Special Investigations in Composition of Milk.** An extended series of investigations is under way regarding the factors that influence the composition of normal milk. A certain number of students are allowed to assist in these investigations and to undertake small problems independently. Mr. PALMER.

204. **Dairy Bacteriology.** This will be laboratory investigation of certain problems of bacteriology in relation to dairying, the object being chiefly to give training in methods of research in this line. The work will be adapted largely to the individual student. Mr. ECKLES.

205. **Dairy Manufactures.** Opportunity and facilities are given to study and investigate problems in butter-making, cheese-making, and other lines of dairy manufactures. Mr. RINKLE.

ENTOMOLOGY

110b. **Advanced Economic Entomology.** Open only to students who have taken course 2a or 2b. Lectures, laboratory, and field work. Two afternoon periods a week by appointment. (2) Mr. HASEMAN; Mr. HOLLINGER.

111a. **Morphology, Histology, and Development of Insects.** Open only to students who have taken courses 2a or 2b, 103a, and 104b. Lectures and demonstrations. (3) Mr. HASEMAN.

200. **Research.** Opportunity is offered for original investigation of economic, morphologic, and systematic problems presented by our local insect fauna. Mr. HASEMAN.

FARM CROPS

102b. **Cereal Breeding.** Prerequisite: courses 1a or 1b and 2a or 2b or their equivalent. A study of the principles and methods of plant breeding as applied to cereals and forage crops. Laboratory exercises in studying methods in use at the Agricultural Experiment Station and in the use of biometrical methods in analyzing data. One lecture and one laboratory period a week. (2) Mr. HUTCHISON.

201. **Research.** Original research in problems pertaining to the production, management, and improvement of farm crops. Hours by appointment. Mr. HUTCHISON.

202. **Seminary.** Discussion of various phases of investigations pertaining to the production, management, and improvement of farm crops. Papers on assigned topics are presented for discussion. (1) Mr. HUTCHISON.

FARM MANAGEMENT

112a. **Farm Records.** Prerequisite: course 105a. A detailed study of the results of record work—what the records reveal in the way of successful or unsuccessful management and methods. (2) Mr. JOHNSON.

113b. **Farm Administration.** The application of the principles gathered in course 110b; making detailed and balanced plans for special farms and considering the handling and management of crops and stock under those special conditions. (2) Mr. JOHNSON.

114. Seminary. Selected literature and special field investigations of farm management problems, to be used as the basis for original outlines, and detailed plans for improving systems of farming. Mr. JOHNSON; Mr. FOARD.

201. Investigation of Types of Farming. Field investigations of the different types of farming occurring in a given region, including careful and detailed study of farm practices and incomes. Thesis required. Mr. JOHNSON; Mr. FOARD.

202. Investigation of Cost of Production and the Distribution of Labor. Field investigations of the comparative cost of producing farm products and the distribution of labor on Missouri farms. Thesis required. Mr. JOHNSON; Mr. FOARD.

207. Investigation of Systems of Farm or Rural Practices and Organizations. Original research covering present farm practices and their practical application. Also a study of rural institutions or organizations that directly affect or are related to farm management. Thesis required. Mr. JOHNSON; Mr. FOARD.

HORTICULTURE

111. Advanced Pomology. A study of the principal species, types, and varieties of cultivated fruits and their related forms, together with a consideration of their variations, modifications, and adaptations under culture. The living plant collections and preserved specimens on the horticultural grounds afford material for the work. Hours by appointment. Mr. WHITTEN.

113. Olericulture. Exhaustive studies of special groups, species, types, and varieties of garden vegetables, together with their cultural requirements and adaptations to special purposes. Mr. WHITTEN.

114. Ornamental Plants. Prerequisite: Botany, course 4b; Horticulture, course 8b. Lectures, laboratory, and assigned readings on the identification and classification of ornamental plants used in Landscape gardening. The making of herbaria. (3) Mr. MAJOR.

115a. Elementary Landscape Design. Prerequisite: courses 8b and 114. Draughting-room exercises. (3) Mr. MAJOR.

215. Special Investigation. This course is intended for graduates and advanced students. Special topics for investigation will be assigned. Hours by appointment. Mr. WHITTEN; Mr. MAJOR.

SOILS

100a. Soil Management. A study of the practical phases of soil management, including the most improved systems of tillage, cropping, and fertilization for Missouri conditions; laboratory studies of soils from the Agricultural Experiment Station field or from the home farms of students. Two lectures and three laboratory periods a week. Students

interested merely in the practical handling of soils may take the lectures only; those interested in laboratory study may take the laboratory only; credit will be given accordingly. (5) Mr. MILLER; Mr. HUDELSON.

102a. **Soil Surveying.** Practice in the making of soil surveys. The course will include the making of plane table maps and the mapping of soil types in detail on the scale of two inches to the mile, the work being done in the neighborhood of Columbia. Soil samples will be taken from each type and subjected to mechanical analysis in the laboratory. This course is designed to prepare students for soil survey work. Two laboratory periods per week. (2) Mr. LECLAIR.

103b. **Soil Investigations.** A study of methods of soil investigation and of special soil problems. Particular attention is given to methods and results of soil investigations in the United States and Europe. One lecture and two laboratory periods a week. (3) Mr. MILLER; Mr. LECLAIR.

200. **Seminary.** Discussion of various phases of soil investigations. Papers on assigned topics are presented for discussion. A reading knowledge of French and German is recommended. (1) Mr. MILLER.

201. **Soil Research.** Original investigations in soils. The special work undertaken is determined by the preparation and the needs of the student. Hours to be arranged. Mr. MILLER.

VETERINARY SCIENCE

201. **Topographic Veterinary Anatomy.** Prerequisite: course 1a. A study of the topographic anatomy of the horse, ox, and pig by means of serial cross-sections of preserved cadavers, supplemented by a study of anatomical surface points on the living subject.

This course is designed to meet the needs of advanced students who intend to specialize in animal husbandry along the lines of stock judging and meat production. (3) Mr. CONNAWAY.

202. **Contagious, Infectious, and Parasitic Diseases of Farm Animals.** In this course an effort is made to present as many clinical cases as possible, in order that the student may gain a practical knowledge of the clinical features as they are encountered in field experience. Experimental inoculations supplement the clinical study. Autopsies are made and the gross and microscopic lesions studied. The specific causes (bacteria and other micro-parasites and macro-parasites), where known, are isolated and studied. Such ground relating to this group of diseases as has been well covered in the minor course 3a is not repeated in this course. Text and reference books: Hutyra and Marek's *Veterinary Pathology*; Law's *Vet. Med.*, IV; Ostertag and Wilcox's *Meat Inspection*; Neumann's *Parasites and Parasitic Diseases*; Nocard and Loclainche's *Les Maladies Microbiennes des Animaux*; Kitt's *Bacterienkunde*; Herzog's *Disease Producing Microorganisms*. Special bulletins and veterinary journals. Lectures, assigned reading, clinics, and laboratory work. (3) Mr. CONNAWAY.

203. **Investigation.** Students who have suitable preparation will have an opportunity to assist in the Agricultural Experiment Station work. Studies on immunity in relation to hog cholera, infectious abortion in cattle, and roup in chickens will be continued during the coming session. (6) Mr. CONNAWAY.

ENGINEERING

CHEMICAL ENGINEERING

For the courses in chemical engineering see Chemistry, courses 126b, 127, 133, 142b, 211a, 212b, 221, 271.

CIVIL ENGINEERING

105b. **Geodetic Surveying.** Elements of geodesy, with practice in use of precise instruments and reduction of triangulation. (3) Mr. WILLIAMS.

114a. **Railway Maintenance.** Maintenance of track; signals; organization of engineering departments; accounting. (3) Mr. MILLER.

115b. **Railway Yards and Terminals.** Arrangement of terminal facilities for handling of both passenger and freight business; design, construction, and operation of yards of several kinds and types. (2) Mr. MILLER.

123b. **Higher Structures.** Swing bridges; arches; suspension and cantilever bridges; deflection of trusses. (3) Mr. HYDE.

126a. **Concrete Structures.** Theory of reinforced concrete structures with problems in design. (3) Mr. SPALDING.

143a. **Irrigation and Drainage.** Irrigation engineering, institutions, and practice; canals; ditches; reservoirs; land drainage. (2) Mr. RODHOUSE.

144b. **Rivers and Canals.** River improvements, training works, floods, levees, dredging, shore protection; waterways, canals and locks; river discharge. (2) Mr. RODHOUSE.

154a. **Municipal Sanitation.** General sanitation; garbage reduction; street cleaning; sewage disposal; water purification. (2) Mr. McCAUSTLAND.

157b. **Sanitary Design.** Design of works for sewage disposal and water purification. (2) Mr. McCAUSTLAND.

201. **Geodesy and Precise Surveying.** Credit to be arranged. Mr. WILLIAMS.

211. **Railway Engineering.** Advanced course in construction, maintenance, and operation. Credit to be arranged. Mr. MILLER.

221. **Structural Engineering.** Special problems in advanced design. Credit to be arranged. Mr. HYDE.

222. **Concrete Structures.** Theory and design of concrete structures; special laboratory investigations. Credit to be arranged. Mr. SPALDING.

223. **Theory of Structures.** Statically indeterminate structures secondary stresses. Credit to be arranged. Mr. HYDE.

231. **Experimental Investigation.** Hydraulic laboratory. Laboratory investigations concerning the properties and uses of the materials of construction. Credit to be arranged.

241. **Hydraulic Engineering.** Problems in hydraulics, irrigation, river and harbor improvements; hydraulic construction. Credit to be arranged. Mr. RODHOUSE.

251. **Sanitary Engineering.** Investigations and special problems in sanitary engineering. Credit to be arranged. Mr. McCAUSTLAND.

ELECTRICAL ENGINEERING

131b. **Electric Motors.** Prerequisite: course 103b or 110a. Construction, characteristics, and applications of electric motors to various classes of service. Comparison between electric and other methods of drive as to costs of installations, operating expenses, flexibility, convenience. (2) Mr. WEINBACH.

132a. **Storage Battery Engineering.** Prerequisite: course 111a. Theory, operating characteristics, and application of electric storage batteries; problems in the economic considerations of standby service, load equalization, and vehicle work. (2) Mr. GUMAER.

133b. **Illumination.** Prerequisite: Physics, course 3. Characteristics of commercial types of electric lamps and their application to interior and exterior lighting. Problems in design of lighting systems from the standpoint of cost and satisfactory operation. (3) Mr. ATKINSON.

134a. **Telephony.** Design and operation of telephone systems. Electrical transmission and reproduction of speech. Propagation of high frequency alternating currents in cables and overhead lines. Switchboard systems, manual and automatic. Types of line construction. Telephone traffic studies; facilities required. A few periods are devoted to laboratory work. Lectures and recitations. (2) Mr. KELLOGG.

141b. **Electric Railway Engineering.** Prerequisite: course 130a. Electric railway systems; equipment and operation. Economic conditions governing the construction of an electric road. Methods of determining costs of equipment; determination of problem of gross earnings, fixed charges, operating expenses, maintenance. (2) Mr. WEINBACH.

142b. **Transmission.** Prerequisite: course 111a. Transmission of electric power. Economical aspects, practical limitations, operating precautions, and protective apparatus against disturbances originating in the various parts of the system. (2) Mr. GUMAER.

143b. **Electrical Processes.** Miscellaneous practical applications of electricity in electro-chemical and metallurgical industries, including electroplating; electric welding; the theory, construction, and operation

of electric furnaces. A few periods are devoted to laboratory work. (2) Mr. WEINBACH.

144. **Central Station Management and Operation.** Detailed study of problems of existing plants from the viewpoint of economical operation and satisfactory service. (2) Mr. WEINBACH.

180a or b. **Applications of Mathematics to Electrical Engineering.** Prerequisite: Mathematics, course 6. Stating the problem in mathematical form; approximate solutions; derivations of empirical formulæ, solutions of equations by graphical methods, application of complex numbers, exponential functions, and differential equations to electrical engineering problems. (2) Mr. GUMAER.

214a or b. **Transient Electrical Phenomena.** An advanced study of surges and oscillations which occur in high tension electrical apparatus. (2) Mr. GUMAER.

230a or b. **High Tension Laboratory.** (2) Mr. GUMAER.

231a or b. **Special Electrical Laboratory.** (2) Mr. WEINBACH.

Courses 230 and 231 will be adapted to meet the attainments of individual students. Definite problems will be assigned which must be studied through existing literature and by experimental work.

240a or b. **Electrical Power Plant Equipment.** A continuation of course 140b, with special study of problems in switching, voltage control, metering, and arrangement of electrical apparatus. (2) Mr. KELLOGG.

270a or b. **Advanced Telephone Engineering.** Studies of special problems; laboratory work in transmission. (3) Mr. KELLOGG.

290. **Research.** Original investigations along various lines in electrical engineering. Students taking research work will have as advisers those members of the staff most conversant with the problem undertaken.

MECHANICAL ENGINEERING

113a or b. **Hoisting and Conveying Machinery.** (2) Mr. WESTCOTT.

138a. **Boiler Design.** Design, construction, and operation of steam boilers. Studies of increased rates of heat transmission, and probable future boiler practice. Credit to be arranged. Mr. FESSENDEN.

201a or b. **Special Machine Design.** Advanced work in kinematics, graphics, materials, and the design of apparatus and machinery for specific work. Credit to be arranged. Mr. HIBBARD; Mr. FESSENDEN.

211b. **Shopwork Engineering, B.** Prerequisite: course 111 or course 112. Advanced analyses in production engineering. Shop betterment. New mechanisms in efficiency management. Motion studies. (2) Mr. HIBBARD.

221a and b. **Special Mechanical Laboratory.** Advanced work in experimental engineering research. Tests of steam, gas and water power producing machinery, steam boilers and furnaces, gas producer. Complete plant tests. Locomotive tests. Combustion engineering. Tests

on the experimental lathe and in commercial shops. Studies of the uses and development of indicating and recording apparatus as a means of increasing operating efficiencies. Credit to be arranged. Offered by members of the staff in their respective lines.

231b. Thermodynamics, B. Prerequisite: course 139a. General thermodynamic methods; thermal magnitudes, relations, and analytical investigations; mathematical-physical and engineering applications. References to Zeuner, Planck, Preston, and other authorities. (2) Mr. WHARTON.

232b. Advanced Steam Turbine Design. Credit to be arranged. Mr. FESSENDEN.

238. Gas Engineering. Prerequisite: Machine Design, either course 139a, or course 132a and Prime Movers. First semester on theory and practice of internal combustion motors; fuel mixture, flame propagation, ignition, valve action, and speed effects. Regulation, performance, installation, and operation; selective design. Second semester on the production, preparation, transmission, and use of industrial gases: natural gas, producer gas, coal gas, etc. (2) Mr. WHARTON.

251b. Refrigeration, B. Prerequisite: a course in elementary thermodynamics, preceded or accompanied by Steam Machinery or Prime Movers; and course 154b. Designs, plans, specifications, estimates for one or more selected studies as ice factory, cold storage, district refrigeration, nursery, market, etc. Research, tests, improvements, appraisal, sales, management. Credit to be arranged. Mr. WHARTON.

253a. Power Transmission. Power, lighting, heating and ventilation for buildings, shops, plants, industrial institutions, and towns. Credit to be arranged. Mr. HIBBARD; Mr. FESSENDEN.

261a or b. Railway Mechanical Engineering. 1. Locomotive design, divided into boiler plant, carriage, and steam engine. Compounding, superheat, articulated. 2. Locomotive operation: service, maintenance, fuels, locomotive terminals; testing; train resistance. 3. Car design. 4. Railway shops: the layout, design, equipment, and operation of central shops for the general repair of locomotives and cars. Credit to be arranged. Mr. HIBBARD.

MECHANICS

112. Advanced Mechanics. Problems in dynamics. (3) Mr. DEFOE.

205. Elasticity. Mathematical theory of elasticity. (3) Mr. DEFOE.

209. Hydrodynamics. Mathematical theory of the motion of fluids. (2) Mr. DEFOE.

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Associate Professor of Mathematics.
- WALTER SCOTT WILLIAMS, C. E.,
Associate Professor of Topographic Engineering.

GUY BLANDIN COLBURN, A. B., A. M., Ph. D.,
Assistant Professor of Latin.

JAMES ANDREW GIBSON, B. A., M. A.,
Assistant Professor of Analytical Chemistry.

ADDISON GULICK, A. B., A. M., Ph. D.,
Assistant Professor of Physiology.

LEONARD HASEMAN, A. B., A. M., Ph. D.,
Assistant Professor of Entomology, and Entomologist to the Agricultural Experiment Station.

LOUIS INGOLD, A. B., A. M., Ph. D.,
Assistant Professor of Mathematics.

OLIVER RAY JOHNSON, B. S. in Agr., A. M.,
Assistant Professor of Farm Management.

HORACE FAIRCHILD MAJOR, B. S. A.,
Assistant Professor of Landscape Gardening, and Superintendent of Grounds.

CHARLES ROBERT MOULTON, B. S. in Ch. E., M. S. in Ag., Ph. D.,
Assistant Professor of Agricultural Chemistry.

LEROY SHELDON PALMER, B. S. in Ch. E., A. M., Ph. D.,
Assistant Professor of Dairy Chemistry.

WILLIAM HENRY PYLE, A. B., Ph. D.,
Assistant Professor of Educational Psychology.

JAMES WALTER RANKIN, A. B., A. M., Ph. D.,
Assistant Professor of English.

HARVEY CLAYTON RENTSCHLER, A. B., A. M., Ph. D.,
Assistant Professor of Physics.

LOREN GEORGE RINKLE, B. S., M. S.,
Assistant Professor of Dairy Husbandry.

GILBERT CAMPBELL SCOGGIN, A. B., A. M., Ph. D.,
Assistant Professor of Greek and Comparative Philology.

FRANK FLETCHER STEPHENS, Ph. B., Ph. M., Ph. D.,
Assistant Professor of American History.

CAROLINE TAYLOR STEWART, A. B., A. M., Ph. D.,
Assistant Professor of Germanic Languages.

WILLIAM ARTHUR TARR, S. B., S. B. in M. E.,
Assistant Professor of Geology and Mineralogy.

JACOB WARSHAW, A. B., A. M., Ph. D.,
Assistant Professor of Romance Languages.

MENDEL PENCO WEINBACH, A. B., B. S. in E. E., A. M.,
Assistant Professor of Electrical Engineering.

ARTHUR LORD WESTCOTT, B. M. E., M. E.,
Assistant Professor of Mechanical Engineering.

JESSE ERWIN WRENCH, A. B.,
Assistant Professor of History.

LEON ARDZROONI, A. B., M. A.,
Instructor in Economics.

KERR ATKINSON, M. E.,
Instructor in Electrical Engineering.

MARTIN KAHAO BROOKS, A. B., A. M.,
Instructor in Romance Languages.

HILLIER McCLURE BURROWES, A. B.,
Instructor in English.

MICHAEL C. CARR,
Instructor in Theory and Practice of Art.

JOHN MEYNARD CARTER, A. B.,
Instructor in Physiology.

GIUSEPPE CHERUBINI,
Instructor in Romance Languages.

PAUL HARRISON DIKE, B. S., M. S., Ph. D.,
Instructor in Physics.

OTTO DUNKEL, M. E., B. A., M. A., Ph. D.,
Instructor in Mathematics.

MARTIN W. DUPRAY, B. S., M. S.,
Instructor in Bacteriology and Preventive Medicine.

WILLIAM EUPHRATES FOARD, B. S., A. M.,
Instructor in Farm Management.

PERCY WILCOX GUMAER, A. B., B. S. in E. E.,
Instructor in Electrical Engineering.

MAX SYLVIUS HANDMAN, A. B.,
Instructor in Sociology.

MINER LEWIS HARTMAN, B. S.,
Instructor in Chemistry.

HEBER MICHAEL HAYS, A. B.,
Instructor in Greek and Latin.

WEBSTER NEWTON JONES, A. B., A. M.,
Instructor in Organic Chemistry.

MARY LUCILLE KEENE, A. B., B. S. in Ed., A. M.,
Instructor in Botany.

EDWARD WASHBURN KELLOGG, C. E.,
Instructor in Electrical Engineering.

ROBERT JOSEPH KERNER, A. B., A. M., Ph. D.,
Instructor in History.

THEOPHILE KARL THEODORE KRUSE, A. B.,
Instructor in Physiology.

CARLOS AMIE LE CLAIR, B. S. in Agr., A. M.,
Instructor in Agronomy.

EDWARD MATHIEU, A. B., A. M.,
Instructor in Romance Languages.

DANIEL CARROLL McEUEN, A. B., A. M.,
Instructor in English.

ALMON ERNEST PARKINS, B. Pd., A. B., B. S.,
Instructor in Geology.

LAWRENCE MARSDEN PRICE, A. B., A. M., Ph. D.,
Instructor in German.

GEORGE WASHINGTON TANNREUTHER, A. B., A. M., Ph. D.,
Instructor in Zoology.

FELLOWS AND SCHOLARS, 1914-1915

University Fellows:

VIVIAN HONORA BRESNEHEN, A. B., A. M., University of
Missouri,
English.

CHARLES AMOS DICE, A. B., Ohio Northern University; B. D.,
Drew Theological Seminary; A. M., Harvard University,
Sociology.

RODNEY POTTER ROBINSON, A. B., A. M., University of
Missouri,
Latin.

EULA ADELINE WEEKS, A. B., B. S. in Ed., A. M., University of
Missouri,
Mathematics.

University Scholars:

MAUDE BEAMER, A. B., B. S. in Ed., University of Missouri,
Latin.

SELWYN DE WITT COLLINS, A. B., University of Missouri,
Economics.

HENRY LOUIS DAHM, A. B., St. Louis University,
Chemistry.

JULIA ELIZABETH GROVES, A. B., University of Colorado,
Romance Languages.

PANSY GOLDIE HIGBEE, B. S. in Ed., A. B., University of
Missouri,
History.

FRANKLIN PLOTINUS JOHNSON, A. B., University of Missouri,
Greek.

ALBERT GEYER LOOMIS, A. B., University of Missouri,
Chemistry.

MALTA CLARRIE LUKENS, A. B., University of Missouri,
English.

MARTHA REED SINGLETON, A. B., B. S. in Ed., University of
Missouri,
Latin.

JULIA SPALDING, B. S. in Ed., University of Missouri,
Mathematics.

MAY VIOLET WALLACE, A. B., University of Kansas,
Home Economics.

ELEANOR CHAMPION WILKES, B. S. in Ed., University of
Missouri,
History.

GEORGE WASHINGTON WILLIAMS, A. B., University of Mis-
souri,
Anatomy.

Peabody Scholar:

ABNER JONES, A. B., B. S. in Ed., University of Missouri,
Education.

Agricultural Research Scholars—Agricultural Experiment Station:

FRANK LESLIE DULY, B. S. in Agr., University of Missouri,
Soils.

OSCAR LITTLE FARRIS, B. S. in Agr., University of Tennessee,
Animal Husbandry.

DANIEL JAMES GRISWOLD, Jr., B. S. in Agr., University of
Missouri,
Agricultural Chemistry.

JUSTUS HAROLD HURSH, B. S. in Agr., University of Missouri,
Farm Management.

HUBERT DUDLEY LEPPAN, B. S. A., Ontario Agricultural
College,
Agronomy.

CHARLES DESMOND MATTHEWS, B. S. in Agr., University of
Missouri,
Botany.

LLOYD STEPHEN RIFORD, B. S. in Agr., New Hampshire State
College,
Dairy Husbandry.

JOHN MORGAN ROBERTS, B. S. in Agr., A. and M. College,
North Carolina,
Agronomy.

BRYAN WATKINS WHITFIELD, B. S. in Agr., Alabama Polytech-
nic Institute,
Animal Husbandry.

JAMES FRENCH WILSON, B. S. in Agr., University of Wyoming,
Animal Husbandry.

UNIVERSITY CALENDAR

AT COLUMBIA

1915

Summer Session

June 10.....	Thursday, registration
June 11.....	Friday, organization of classes
August 6.....	Friday, examinations
August 7.....	Saturday, entrance examinations

First Semester

September 13, 14, 15.....	Monday, Tuesday, and Wednesday, entrance examinations and registration
September 16.....	Thursday, 8 a. m., class work in all divisions begins
September 16.....	Thursday, 10 a. m., opening convocation
November 1 to December 17,	First term, Short Course in Agriculture.
November 25.....	Thursday, Thanksgiving, holiday
December 17.....	Friday, 4 p. m., to
1916	} Christmas holidays
January 4.....	
January 10 to February 26,	Second term, Short Course in Agriculture.
January 22.....	Saturday, to
January 29.....	Saturday
January 27, 28, 29.....	Thursday, Friday, and Saturday, entrance examinations

Second Semester

January 31, February 1....	Monday and Tuesday, registration, second semester
February 2.....	Wednesday, 8 a. m., class work in all divisions begins
February 3.....	Thursday, 10 a. m., opening convocation
February 22.....	Tuesday, Washington's Birthday, holiday
April 19.....	Wednesday, 4 p. m., to
April 25.....	Tuesday, 8 a. m.
May 28.....	Sunday, baccalaureate address
June 1.....	Thursday, commencement day
June 2.....	Friday, to
June 9.....	Friday

} Easter holidays

} Final examinations

INFORMATION ABOUT THE UNIVERSITY GENERAL STATEMENT

The fundamental aim of the University of Missouri is the development of the highest and most efficient type of citizen. For the purpose of attaining its aim, the University furnishes ample facilities for liberal education and for thorough professional training. The University is a part of the public educational system of the state.

ORGANIZATION

The work of the University is now carried on in the following divisions:

- College of Arts and Science
- College of Agriculture
- School of Education
- School of Law
- School of Medicine
- School of Engineering
- School of Mines and Metallurgy
- School of Journalism
- School of Commerce
- Graduate School
- Extension Division

All of these divisions are at Columbia, with the exception of the School of Mines and Metallurgy, which is located at Rolla. In addition, emphasis is given particular lines of work by the establishment of minor divisions, the chief of which are the Agricultural Experiment Station, the Engineering Experiment Station, and the Missouri State Military School.

LOCATION

The University of Missouri is located at Columbia, situated half way between St. Louis and Kansas City, near the center of the state. It is reached by the Wabash and by the Missouri, Kansas and Texas railways. Columbia is a progressive and prosperous town having doubled its population in the last few years.

Columbia may be characterized as a town of schools, homes, and churches, with enough of industrialism to make it efficient. It offers the conveniences of a larger city without the counter attractions. The student is a predominant factor in Columbia.

EQUIPMENT

The University grounds cover more than 800 acres. The main divisions are in the west campus, the east campus, the athletic fields, and the agricultural college farm.

The following University buildings are located at Columbia: Academic Hall; Laws Observatory; separate buildings for chemistry, physics, biology, geology, engineering, manual arts, law, commerce; two power houses; Medical Laboratory Building; Parker Memorial Hospital; Agricultural Building; Horticultural Building; Schweitzer Hall for agricultural chemistry; green houses; Live Stock Judging, Poultry, Dairy, Farm Machinery, and Veterinary Buildings; the agricultural college farm barns and buildings; Switzler Hall for the School of Journalism; Gordon Hotel Building for home economics; Benton and Lathrop Halls, dormitories for men; Read Hall and Sampson Hall, dormitories for women; Rothwell Gymnasium; the houses for the President of the University and the Dean of the College of Agriculture; the High School and the Elementary School buildings, used for practice schools in the School of Education. The new library building will be occupied in the course of the summer of 1915.

FOR FURTHER INFORMATION

For further information in regard to the Graduate School of the University, address

DEAN OF THE GRADUATE FACULTY,
UNIVERSITY OF MISSOURI,
COLUMBIA, MISSOURI.

Full information regarding the University is given in the catalogue, which will be sent on request without charge. For this or special bulletins of the College of Arts and Science, College of Agriculture, School of Education, School of Law, School of Medicine, School of Engineering, School of Journalism, School of Commerce, Extension Division, and the Graduate School, write to

DEAN OF THE UNIVERSITY FACULTY,
UNIVERSITY OF MISSOURI,
COLUMBIA, MISSOURI.

THE
UNIVERSITY OF MISSOURI
BULLETIN
VOLUME 16

Issued Three Times Monthly

GENERAL SERIES

EDITED BY
HUGH J. MacKAY
University Publisher

The General Series of The University of Missouri Bulletin consists of the announcements of the various colleges and schools which make up the University. These announcements will be sent free upon request to the Dean of the University Faculty, Columbia, Missouri.

Published by
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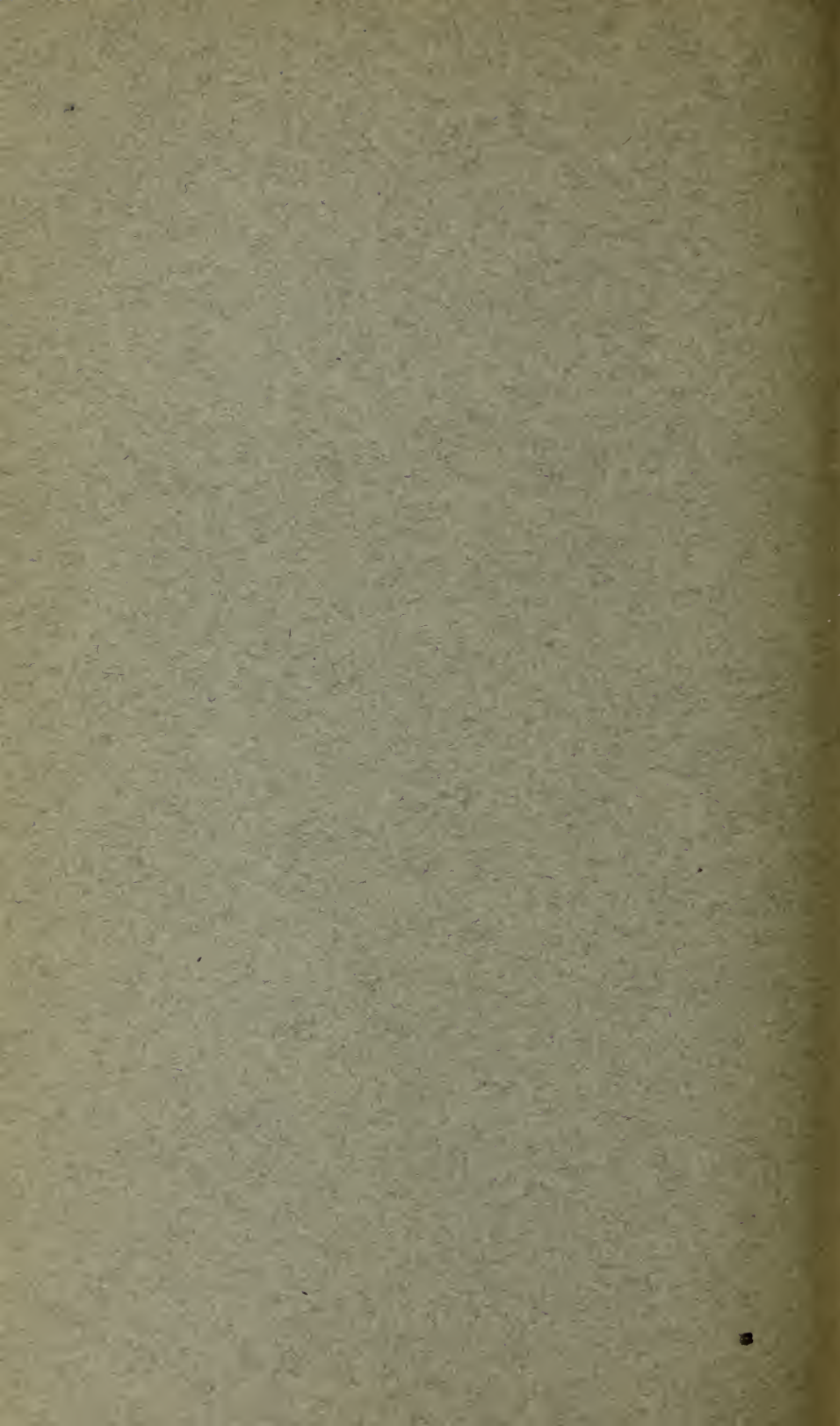
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GENERAL SERIES
1915, No. 12

ANNOUNCEMENT
OF THE
GRADUATE SCHOOL
1916-1917



UNIVERSITY OF MISSOURI
COLUMBIA, MISSOURI
October, 1915



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October, 1915

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Announcement of the Graduate School

GENERAL STATEMENT

Admission:

Graduates of the colleges and universities comprising the Missouri College Union and of other reputable colleges and universities are admitted to the Graduate School. Admission to this school, however, shall not be understood as implying admission to candidacy for advanced degrees, which is subject to the regulations indicated below. Students are admitted to the Graduate School by the Dean of the University Faculty to whom applications for admission should be addressed.

Fees and Expenses:

Students are required to pay a library, hospital, and incidental fee of \$12 a semester. Those who file their study cards after the close of the last day of registration will be required to pay an additional fee of \$5 for late registration. Students taking laboratory work must make small laboratory deposits. The estimated cost of room rent and board for students living in Lathrop or Benton Hall, the dormitories for men, varies, according to the room, from \$3.50 to \$4.50 a week. In Read or Sampson Hall, the dormitories for women, it varies, according to the room, from \$5.75 to \$6.25 a week. The total necessary expenses of a student living in the dormitories for men need not exceed \$250 a year; in the dormitories for women they need not exceed \$350. The necessary expenses for students living in private families vary from \$4 to \$6 a week.

University Fellowships and Scholarships:

The University offers annually a limited number of University Fellowships yielding each a stipend of \$400 a year. These fellowships will be awarded, according as the applicants, irrespective of department, have demonstrated their ability to render service in the form of research. The University offers also a limited number of scholarships bearing stipends of \$200 annually, open to graduate students of high promise in scholarship, irrespective of the lines of work they may desire to pursue. It is expected that scholars will be well qualified to do graduate work in the subjects which they elect and that they will devote themselves mainly to work in these subjects. They will be called upon to render a limited amount of service to the University. University

fellows and scholars are allowed to engage in outside work only with the consent of the Dean of the Graduate Faculty and the professor of the subject which they elect. The Executive Board, upon the recommendation of the dean and professor, may deprive any student of his fellowship or scholarship, whenever it may appear that he is not devoting himself as he should to his work as fellow or scholar. Applications must be filed not later than March 1, in order to receive consideration in the award for the following academic year. Applications received after this date and not later than June 1 will be considered in filling any vacancies that may occur in the fellowships or scholarships. Application blanks may be obtained from the Registrar of the University and when filled out should be sent to the Dean of the Graduate Faculty, Columbia, Missouri.

Gregory Fellowships and Scholarships:

By the terms of the will of the late Charles R. Gregory of St. Louis, Missouri, the residue of his estate, amounting to approximately \$225,000, after providing for numerous bequests to charitable institutions, was left to the University of Missouri at Columbia to establish "The William Alexander Gregory Educational Fund." This must be invested by the Board of Curators "in a safe and prudent manner, the income from which shall be used in assisting white students of either sex in obtaining an education in any of the courses in said institution."

The Board of Curators has seen fit to provide that not more than \$1500 annually from this income may be used for the establishment and maintenance of fellowships and scholarships in the Graduate School to be known as the "Gregory Fellowships and Scholarships." These are awarded on the same conditions as the University fellowships and scholarships.

Peabody Fellowship in Education:

In June, 1912, the trustees of the Peabody Education Fund gave the University the sum of \$6,000 on condition that it be held and used as an endowment of a Peabody Graduate Fellowship in education. The annual income from this fund will be paid to the holder of the fellowship.

Curators' Scholarships:

By order of the Board of Curators, the student who attains the highest grade, or who shall be first in merit, in taking a bachelor's degree, in the graduating class of any of the colleges or universities composing the Missouri College Union, will be admitted to this University for the first year without the payment of tuition, library, hospital, and incidental fees.

Agricultural Research Fellowships and Scholarships:

The University offers annually a limited number of research fellowships in the Agricultural Experiment Station, each of the value of \$400,

and scholarships, each of the value of \$200. It is the purpose of these fellowships and scholarships to foster and encourage original investigation and to give opportunity to students who desire to become efficient investigators in the field of agricultural science. All candidates for these fellowships and scholarships must fulfil the requirements for admission to the Graduate School of this University. (See page 3.)

These fellowships and scholarships are available in the departments of agricultural chemistry, animal husbandry, dairy husbandry, horticulture, botany, entomology, farm crops, and soils. They will be awarded to the candidates who are best prepared and are of the highest promise in scholarship. Application blanks for these fellowships may be obtained from the Director of the Agricultural Experiment Station, Columbia, Missouri. Applications must be filed not later than March 1, in order to receive consideration in the award for the next academic year. Applications received after this date will be considered in filling any vacancies that may occur in these fellowships.

United States Department of Agriculture Research Fellowship in the Improvement of Cereal Crops:

The Bureau of Plant Industry of the United States Department of Agriculture has recently provided for a fellowship in cereal crops in the University of Missouri, bearing an annual stipend of \$400. This is the only fellowship of the kind offered in the United States. It is to be awarded to a graduate student in the University who has received special training for such investigations.

The purpose of these investigations shall be (a) to improve the cereal crops of the Central Mississippi Valley region as regards yield, quality, disease resistance, earliness, stiffness of straw, winter-hardiness, etc.; (b) to determine the best methods of cereal production; and (c) to study the fundamental laws of breeding and inheritance in cereals.

Literary and Scientific Societies:

A number of literary and scientific societies are maintained in the University.

The following, conducted by members of the faculties, are open to advanced students: "The Scientific Association," organized with a "General Section" and special sections of "Biological Science," "Mathematical and Physical Science," and "Social and Political Science;" "The Philological Club," "Mathematical Journal Club," and "The University of Missouri Section of the American Chemical Society."

The following, among others, are conducted by students, in some cases with the participation of members of the faculties: "Medical Society," "Engineering Society," "Der Deutsche Klub," "French Club," "Sketch Club," "Asterisk Club," "History Club," "Branch of the American Institute of Electrical Engineers," "Branch of the American Society of Mechanical Engineers," "Physics Club," and "Forestry Club."

Publications:

The "University of Missouri Studies," several series in "The University of Missouri Bulletin," and the "Publications of the Agricultural Experiment Station" are maintained as a means of publishing the results of original research in the University by instructors and graduate students.

University Libraries, Laboratories, and Museums:

LIBRARIES. The University libraries comprise the general library and many departmental libraries. They contain about 170,000 volumes and pamphlets. Students have access also to the library of the State Historical Society of some 55,000 volumes and pamphlets.

LABORATORIES. Facilities for research in the sciences are provided in the following laboratories: animal husbandry, anatomy, astronomy, bacteriology, botany, chemistry, agricultural chemistry, dairy husbandry, engineering (civil, electrical, sanitary, and mechanical), entomology, experimental psychology, educational psychology, farm crops, geology and mineralogy, horticulture, pathology, pharmacology, physics, physiology, physiological chemistry, soils, veterinary science, and zoology.

MUSEUMS. There are also museums of art, classical archæology, ethnology, geology, and other collections.

Regulations Governing the Degree of Master of Arts:

The degree of Master of Arts is offered to students who have spent at least one year exclusively devoted to advanced courses of study, and who have submitted an acceptable dissertation and passed all prescribed examinations.

A student wishing to make application for this degree must fill out a blank form, provided for the purpose, and must present it to the Dean of the Graduate Faculty on or before October 15.

In order to be accepted as a candidate for the degree, the student must give evidence that he has completed an undergraduate course of study such as is offered by colleges of good standing and that he has received a baccalaureate degree equivalent to the baccalaureate degree of the University of Missouri.

In making application the student must indicate the subject of the dissertation and the course of study selected by him on the form referred to above, which must bear the signature of approval of the professor in charge of his major subject, before it is presented to the dean for final action. He may, however, defer submitting the subject of the dissertation to the dean until November 1.

The candidate must choose a major subject, to which he must devote the greater part of his time during the year, and also such other subjects as may be approved. A majority of all work represented in the course of study must be selected from the courses strictly graduate in character.

A dissertation evincing capacity for original research and independent thought in the subject of the major work must be submitted to the Graduate Faculty for approval on or before May 15. The student should consult the Dean of the Graduate Faculty for information regarding the form in which the dissertation must be presented.

Each candidate for the degree of Master of Arts shall be required to pass final examinations, but the Graduate Faculty, upon the recommendation of the faculty of the department in which the candidate is taking his major work, may excuse the candidate from the requirement of a dissertation.

The attention of students is called to the fact that graduate work cannot be subjected to rigid regulation, and the Graduate Faculty reserves the right to deal with each case on its individual merits.

With the approval of the professors concerned, such candidates as have fulfilled all requirements may, at the close of the year, be recommended by the Graduate Faculty for the degree of Master of Arts.

Regulations Governing the Degree of Doctor of Philosophy:

1. **GENERAL STATEMENT.** The degree of Doctor of Philosophy is offered to students who have pursued advanced courses of study, without serious interruption, for a period of at least three years, and who have submitted an acceptable dissertation and passed all prescribed examinations.

In order to be accepted by the Graduate Faculty as a candidate for the degree of Doctor of Philosophy, the student must give evidence that he has completed an undergraduate course of study such as is offered by colleges of good standing and that he has received a baccalaureate degree equivalent to the baccalaureate degree of the University of Missouri.

The faculty reserves the right to decide in each case whether the antecedent training has been satisfactory, and, if any of the years of advanced work have been passed away from this University, whether they may be properly regarded as spent in university studies under suitable guidance and favorable conditions. Private study or study pursued at a distance from libraries and laboratories will not be considered as equivalent to university work. In any case, the student must spend the year immediately preceding his final examinations in residence at the University of Missouri.

It should be emphasized that the requirements for this degree are not computed in terms of time and courses, but that the degree is conferred only upon such students as have reached, after long study, a high attainment in some special branch of learning and have given the clearest evidence of their ability to carry on independent, original research by reason of having made an actual contribution to knowledge of a character approved by competent judges.

2. **ACCEPTANCE OF CANDIDATES.** A student wishing to make application for the degree of Doctor of Philosophy must fill out a blank form,

provided for the purpose, secure thereto the signature of the instructor with whom he desires to take his major subject and present it to the Dean of the Graduate Faculty for approval on or before October 15. He must also give satisfactory evidence of ability to translate French and German readily at sight.

3. REQUIREMENTS FOR THE DEGREE. (a) Subjects of Study.—Every candidate for the degree must select one principal or major subject, and at least one and not more than two subordinate or minor subjects, the combination to be approved by the Graduate Faculty. The instructor with whom the student is taking his major subject acts as his official adviser and has the general direction of his work.

The student's principal work must be in the major subject. Although no regulations are laid down with respect to the time to be devoted to the major and minor subjects, in general it may be stated that the major subject should represent two-thirds of the student's entire time.

(b) Dissertation.—The dissertation, embodying the results of original investigation, must be written upon a subject approved by the adviser and must be submitted in typewritten form on or before May 15, when it becomes the property of the University. The student should consult the Dean of the Graduate Faculty for information regarding the form in which the dissertation must be presented.

Upon receiving the dissertation a committee is appointed whose duty it is to report upon it in writing to the Graduate Faculty.

The candidate is required to print or publish the dissertation, with such revision as the faculty may allow, and he shall present 150 copies of the work to the library of the University. The faculty shall take any necessary action to insure the publication of the dissertation within one year after the conferring of the degree. A brief biographical sketch of the writer must be appended to the dissertation.

(c) Examinations.—A committee, consisting of the professor of the candidate's major subject and the professors of his minor subjects, is appointed to take charge of all examinations and to report upon the same to the Graduate Faculty in writing.

In addition to final written examinations the candidate may be required to take an oral examination in the presence of the faculty.

(d) Conferring of Degree.—Upon the satisfactory completion of all requirements, the candidate may be recommended by the Graduate Faculty for the degree of Doctor of Philosophy.

COURSES OF INSTRUCTION

Courses preceded by a number with the letter a attached, thus: 104a, 106a, are given the first semester only. Those preceded by a number with the letter b attached, thus: 104b, 106b, are given the

second semester only. Those preceded merely by a number are continuous courses and are given both semesters. The number of hours' credit given for a course for each semester is indicated by the Arabic numerals following the statement of the course. Courses numbered 200 and above are strictly graduate in character.

GROUP OF CLASSICAL LANGUAGES

CLASSICAL ARCHAEOLOGY

106. **History of Greek Art.** A preliminary study of Assyrian and Egyptian art, followed by a study of the development of Greek architecture and sculpture. Lectures, collateral reading, essays, with constant use of the lantern, photographic reproductions, and models and casts in the Museum of Classical Archaeology. Ancient history is recommended to the students of this course. (3) Mr. PICKARD.

107a. **Mycenaean Art or Art of Primitive Greece.** The earliest discoveries at Mycenae, Tiryns, and elsewhere will not be neglected, but special attention will be given to the most recent publications on Troy, Crete, and the Argive Heraeum. (1) Mr. PICKARD.

108b. **Introductory Study of Greek Vases and Vase Paintings.** (1) Mr. PICKARD.

While a knowledge of the Greek language is not an absolute prerequisite for courses 107a and 108b, they are intended for advanced students in Greek.

109. **Etruscan and Graeco-Roman Art.** Should be preceded by course 106. It will deal with the earliest art of the Italian Peninsula, endeavor to show how this art reached its highest development among the Etruscans, how Etruscan influenced early Roman art, how later Roman art grew out of early Roman and late Greek art modified by the circumstances and character of the Romans. Ancient history is recommended to students in this course. (2) Mr. PICKARD.

110. **Roman Life.** A systematic study of the topography of Rome and of extant remains particularly of Rome and Pompeii. Lectures and readings. Illustrated by the use of plans, maps, and lantern slides. As supplementary to this course, Latin, course 105, is recommended. (2) Mr. PICKARD.

214. **Topography and Monuments of Athens.** Frazer's Pausanias will be taken as the basis of discussion. A reading knowledge of Greek, French, and German is required. (2) Mr. PICKARD.

215. **Archaeological Seminary.** Hours and work to be arranged. MR. PICKARD.

For courses in the history of art, see page 43.

GREEK

113a. **The Greek Theater.** The origin and development of the Greek theater will be considered and disputed points in the structure of the theater and in the presentation of plays will be discussed. The basis of the work will be Doerpfeld and Reisch's *Das Griechische Theater*. (1) Mr. MANLY.

114b. **Aristophanes.** Selected comedies will be read and the origin and development of comedy will be considered. Attention will also be given to the life of the people as revealed in the plays. (2) or (3) Mr. SCOGGIN.

216. **Hesiod and Homeric Hymns.** Students should provide themselves with *Hesiodi Carmina* ed. A. Rzach, Teubner, Leipzig, and *Hymni Homericæ* ed. A. Baumeister, Teubner, Leipzig. (2) or (3) Mr. HAYS.

217. **Homer.** The whole of the Iliad and the Odyssey will be read during the year with especial attention to the antiquities. A special subject will be assigned each student for investigation. Teubner text editions of the poems should be secured in advance. (2) or (3) Mr. MANLY.

218a. **Historical Greek Grammar.** Phonology and morphology. The lectures will deal systematically with noun and verb inflection within the Greek language itself. The student should procure Brugmann's *Griechische Grammatik* and Solmsen's *Inscriptiones Graecæ ad illustrandas dialectos selectæ*. (3) Mr. SCOGGIN.

219b. **Historical Latin Grammar.** The sounds and inflections of the Latin language will be set forth briefly in lectures. The student should own Lindsay's *Latin Language* and the same author's *Latin Inscriptions*. (3) Mr. SCOGGIN.

220. **Elementary Sanskrit.** Elements of the language. Translation of Sanskrit into English and English into Sanskrit. Thorough drill in forms. Whitney's *Sanskrit Grammar*; Lanman's *Sanskrit Reader*; and Perry's *Primer*. (3) Mr. SCOGGIN.

221. **Seminary.**

LATIN

101. **Latin Prose Composition.** Prerequisite: course 50. Advanced course. (1) Mr. HAYS.

103a and 104b. **Roman Public and Private Life.** Prerequisite: courses 30 and 70. Reading of Cicero's correspondence and Juvenal's satires. (3) Mr. COLBURN.

Students electing this course are advised to take with it course 109a in history.

106. **Catullus and the Elegiac Poets.** Prerequisite: courses 30 and 70. Selected poems of Catullus, Tibullus, Propertius, and Ovid. (3) Mr. MILLER.

109a. **Latin Comedy.** Not given in 1916-17. Prerequisite: courses 30 and 70. Representative plays of Plautus and Terence. (3) Mr. HAYS.

110a and 111b. **Tacitus, Annals; and Quintilian, X-XII.** Not given in 1916-17. Prerequisite: courses 30 and 70. (3) Mr. COLBURN.

115. **Rapid Reading.** Prerequisite: course 105. History of Latin literature, with readings from authors representative of each period. (2) Mr. COLBURN.

125b. **Lucretius.** Not given in 1916-17. Prerequisite: courses 30 and 70. (3) Mr. HAYS.

217. **Seminary.** Not given in 1916-17. Subject for 1915-16: Cicero's ideal of rhetoric as set forth in his writings on oratory, with intensive study of *De Oratore*. (3) Miss JOHNSTON.

220. **Vergil's Aeneid.** Not given in 1916-17. Comparative literary study of epic poetry; structure and versification; antiquities and topography. Intended primarily for teachers. (2) Mr. MILLER.

225. **Cicero's Orator, Brutus, de Oratore.** The works will be read in the order named, and a special study will be made of Cicero's style as exemplified in his works on oratory. (3) Miss JOHNSTON.

Historical Latin Grammar. See Greek, course 219b.

GROUP OF MODERN LANGUAGES

ENGLISH

101a and 102b. **Advanced Composition.** An informal course in practical composition open to a limited number of upperclassmen who can show that they possess some degree of literary talent. (3) Mr. MILLER.

105a. **Argumentative Address.** Principles of argumentation; practice in the drawing of briefs and in the writing of forensics; debating. (3) Mr. McEuen.

106b. **Debating.** This course naturally follows 105a. Investigation of special questions; practice in debate. Designed especially for members of the debating squad. (3) Mr. McEuen.

109a. **American Oratory.** A study of the oratorical method of typical American orators; practice in writing and speaking. (2) Mr. TISDEL.

110b. **British Oratory.** A study of the oratorical method of typical British orators; practice in writing and speaking. (2) Mr. TISDEL.

113a and b. **English Versification.** A study of the technique of English verse with weekly practice in metrical composition. (2) Mr. MILLER.

119. **The English Language.** Linguistic study, taking first the present facts of the language, especially its vocabulary, its relationships to other languages, its dialects, its spelling, and its pronunciation; and secondly its past development thru each period, with an introduction to Old English. (3) Mr. RAMSAY.

125a. **Chaucer and His Time.** A study of a considerable number of Chaucer's poems; reading of selections from other important authors of the fourteenth century; discussion of the chief types of Middle English literature. (3) Mr. RANKIN.

135a and 136b. **Shakespeare.** *Hamlet; King Lear; Othello; Henry V; The Tempest.* (3) Mr. FAIRCHILD.

145a. **Milton.** Life, works, and times. (3) Mr. FAIRCHILD.

156b. **The Queen Anne Period.** Addison, Steele, Swift, and Defoe; the relation of literature to the political, social, and philosophical movements of the time. (3) Mr. BELDEN.

161a. **The Novel.** A study of the chief characteristics of the novel as a literary form; lectures and readings chosen to show the principal features of the nineteenth century novel. (3) Mr. BURROWES.

162b. **The Rise of English Prose Fiction.** A study of the early forms of narrative in English and of the influences which aided in the development of the novel down to the opening of the nineteenth century. (3) Mr. BURROWES.

165a. **The Romantic Period.** A comprehensive lecture and reading course in the literature of the Romantic period. (3) Mr. TISDEL.

166b. **The Victorian Period.** A comprehensive lecture and reading course in the literature of the Victorian period. (3) Mr. TISDEL.

171a and 172b. **Modern Prose Writers.** A study of the works of representative authors, with weekly reports and monthly essays. (3) Mr. MILLER.

175. **American Literature.** Not given in 1916-17. (a) Sectional development; (b) growth of nationality; (c) present tendencies. The leading writers in prose and verse, considered first as to their intrinsic worth, and secondly as illustrative of national development. (3) Mr. BELDEN.

177a and 178b. **Recent and Current English Literature.** A study of representative writers and literary movements of the last twenty-five years. Special topics: modern drama; the spirit of home in modern literature. (3) Mr. RAMSAY.

180b. **The Foreign Debt of English Literature.** The purpose of the course is to give the student some acquaintance with the greater literary master-pieces of the world and to indicate the nature and to some degree the extent of the influence which they have exerted upon English literature. (3) Mr. RANKIN.

210b. **Style and Usage.** An advanced course in the theory and practice of English composition, involving the investigation of important questions of usage, structure, and style. (3) Mr. MILLER.

219. **Literary Criticism.** The history of critical theory, with reading of standard works; examination of current theories and problems. (3) Mr. FAIRCHILD.

221. **Beowulf.** Not given in 1916-17. The study of the poem will be pursued as an exercise in Old English phonology, in text-criticism, and in the investigation of poetic principles. (3) Mr. BELDEN.

223. **Historical Grammar.** A selected series of topics in the history of the origins and development of the English language. (3) Mr. RAMSAY.

225a. **Middle English Literature.** Language and literature from the Norman conquest to Chaucer, with emphasis on the metrical romances. (3) Mr. RANKIN.

227b. **The Popular Ballad.** A study of popular poetry on the basis of Child's *English and Scottish Popular Ballads*, with analysis of the more important theories of the ballad, and illustrations from balladry in Missouri. (3) Mr. BELDEN.

231. **Seminary.** The Rise of the Drama. Mr. RAMSAY.

235. **Elizabethan Drama.** History of the earlier Elizabethan drama; study of the works of Lyly, Kyd, Greene, Peele, and Marlowe; the doubtful plays of Shakespeare. (3) Mr. FAIRCHILD.

265. **Wordsworth and Coleridge.** Omitted in 1916-17. An intensive study of the work of these authors and the investigation of special topics, historical and critical. Mr. TISDEL.

267. **Tennyson and Browning.** An intensive study of the poetry of these authors and the investigation of special topics, historical and critical. (3) Mr. TISDEL.

GERMANIC LANGUAGES

104a and 104b. **Masterpieces in Modern German Drama, Lyrics, and Novel.** Intensive study, from the literary and cultural side, of a number of carefully chosen Modern German dramas, lyric poems, and novels. Parallel reading and reports. (3) Mr. ALMSTEDT.

105a. **Outline Course in German Literature.** The aim of the course is to acquaint the student with the most important works and movements in the evolution of German literary life. (3) Mr. HOFFMAN.

106b. **Lessing.** Lectures on Lessing's life and works; intensive study of Lessing, the dramatist and the critic; essays written in German; course conducted in German. (3) Miss STEWART.

107a and 108b. **Schiller.** Lectures on Schiller's life and works; intensive study of Schiller's dramas and poetry; essays written in German; course conducted in German. (3) Mr. HOFFMAN.

109a and 110b. **Goethe.** Lectures on Goethe's life and works; intensive study of Goethe's prose, poetry, and dramas; essays written in German; course conducted in German. (3) Mr. ALMSTEDT.

111b. **Outline Course in Historical Grammar.** This course together with course 105a is arranged to meet the needs of the prospective teacher of German. Though a knowledge of the older periods is desirable, it is not required. (3) Miss STEWART.

112b. **Advanced Composition and Conversation.** Advanced course in German theme-writing; discussions of grammatical, syntactical, and stylistic points. This course is intended for teachers of German or for students who propose to become teachers of German; conducted in German. (2) Mr. HOFFMAN.

113b. **Middle High German.** Introductory course. For advanced seniors. The class will study *Der Arme Heinrich* by Hartmann von Aue. Translation of medieval idiom into modern German. (3) Mr. ALMSTEDT.

114b. **German Drama of the Nineteenth Century.** An outline course in modern German political, social, and cultural movements, reflected in certain typical dramatists of this period. Lectures; parallel readings; reports. (3) Mr. NOLLE.

212. **German Literature of the Second Half of the 19th Century.** This course will consist of lectures and reports. During the first semester Hebbel, Ludwig, Freytag, and Wagner will be especially emphasized. The minor authors will be treated in lectures. The second semester will be devoted to a study of the realistic writers of Germany, especially Hauptmann, Sudermann, Wildenbruch, and Fulda. The foreign influence on these writers will be carefully considered. (3) Mr. HOFFMAN.

213b. **Romanticism.** This course is intended to comprise an exhaustive study, as far as is possible, of German romanticists and their works and to show the relation of this movement to similar ones in other literatures. (3) Mr. HOFFMAN.

214a. **The Reformation and Renaissance (1500-1750).** This course is to give the student a clear view of the development and decline of the literary tendencies, forms, and ideals of this period, and the influences that help to develop them or to accelerate their decline. (3) Mr. NOLLE.

215b. **Middle High German.** Walther von der Vogelweide. Discipline in phonology, morphology, syntax; comparison of medieval with modern idiom; a study in lyric poetry. (3) Mr. ALMSTEDT.

216b. **History of the Nibelungenlied.** This course is to comprise a study of the various theories as to the origin and authorship of the poem, the controversies in regard to it, and its relation to the Nibelungensaga and other sagas. A reading knowledge of Middle High German is required. (3) Mr. HOFFMAN.

217b. **Old High German.** Prerequisite: course 220a. Phonology and forms; critical reading of Old High German texts. Texts: Braune,

Althochdeutsche Grammatik and *Althochdeutsches Lesebuch*. (3) Mr. ALMSTEDT.

218a. **Old Norse.** Prerequisite: course 220a. Phonology and forms; critical reading of one or more sagas. Texts: Heusler, *Altisländisches Elementarbuch*; and Heusler, *Zwei Isländer-Geschichten*. (2) Mr. ALMSTEDT.

219b. **Old Saxon.** Phonology and forms; critical reading of the *Heliand*. A desirable antecedent: course 220a. (2) Mr. ALMSTEDT.

220a. **Gothic.** Phonology, morphology, and syntax; reading from *Ulfilas*; the relationship of Gothic to Indo-European and to later Germanic dialects; general introduction to the study of Germanic philology. (3) Mr. ALMSTEDT.

221. **Current Publications.** (1) Miss Stewart.

222. **Seminary.** Subject to be determined. For special students only. (2)

Other courses in Germanic languages will be arranged if the needs of the students require.

ROMANCE LANGUAGES

FRENCH

101. **French Phonetics.** The organs of speech, sound formation, etc.; drill in French pronunciation. (1) Mr. MURRAY.

104. **Composition and Conversation.** Prerequisite: course 3. In exceptional cases, others may be admitted with the consent of the instructor. Translation of standard English into French; original themes; study of syntax, grammatical problems, style; conversation. (2) Mr. BROOKS.

107. **French Drama of the Seventeenth Century.** Prerequisite: course 3 for underclassmen, or the grade of E in course 2 for upperclassmen. In exceptional cases, others may be admitted with the consent of the instructor. The origin and development of classical French drama; its structure, significance, etc.; Corneille, Racine, Molière. (3) Mr. BROOKS.

110. **French Literature and Ideas in the Eighteenth Century.** Prerequisite: course 3. In exceptional cases, others may be admitted with the consent of the instructor. The intense intellectual activities of literary men in the eighteenth century; the influence of French literature on foreign literatures; Montesquieu, Voltaire, Rousseau, the Encyclopedists, etc. (3) Mr. CHERUBINI.

113. **The Romantic School.** Prerequisite: course 3. In exceptional cases, others may be admitted with the consent of the instructor. The origin of the Romantic School in the eighteenth century; foreign influences; the revolt against classicism; the principal writers of the school. (3) Mr. MATHIEU.

115. Recent and Current French Literature. Prerequisite: course 3. In exceptional cases, others may be admitted with the consent of the instructor. Study of modern works from the point of view that some of them will one day become classics; sociological tendencies in the modern novel and drama; symbolists and decadents; the regionalistic movement in the novel; literary criticism as art or science; reading of significant works by Rostand, Richepin, Maeterlinck, Brieux, Bourget, Bazin, Loti, Anatole France, Verhaeren, Régnier, Brunetière, Jules Lemaître. Lectures, conferences, reports. (3) Mr. MURRAY.

116. The Literature of the Sixteenth Century. Not given in 1916-17. Prerequisite: any of the following courses: 107, 110, 113, 115, 117. In exceptional cases, others may be admitted with the consent of the instructor. The first decisive steps in French literary art; Rabelais, as a sociological observer; Montaigne, the philosopher and stylist; Ronsard and the Pléiade, as the ancestors of the Romantic School of the Nineteenth Century; the beginnings of the drama. (2) Mr. WARSHAW.

117. The Language and the Literature Down to the Sixteenth Century. Prerequisite: any of the following courses: 107, 110, 113, 115, 116. In exceptional cases, others may be admitted with the consent of the instructor. (1) Mr. MURRAY.

212. Seminary in French Literature. Detailed study of some literary movement or representative writer. (2), (3), or (4) Mr. MURRAY.

214. General Introduction to Romance Philology. (2) Mr. MURRAY.

215. Old French. Prerequisite: course 214. (2) Mr. MURRAY.

216. Seminary in Romance Philology. Provençal, Old Spanish, Old Italian. (2) Mr. MURRAY; Mr. WARSHAW; Mr. CHERUBINI.

ITALIAN

121. Dante. First semester: *L'Inferno*; second semester: *Il Purgatorio*; *Il Paradiso*. (3) Mr. CHERUBINI.

123b. The Poets of the Rinascimento. (2) Mr. CHERUBINI.

125. Composition and Conversation. (2) Mr. CHERUBINI.

Italian Philology. See courses 214 and 216.

SPANISH

133. Latin-American Literature. Prerequisite: course 31 or equivalent. Rapid reading of Latin-American literary works and of Spanish books dealing with historical and social phases of Latin-American civilization; constant practice in the oral and written use of Spanish. (2) Mr. WARSHAW.

233. Seminary in Spanish Literature. Detailed study of some literary movement or representative writer of significance in the literary history of Spain or of the Latin-American countries. (2) Mr. WARSHAW.

Spanish Philology. See courses 214 and 216.

GROUP OF PHILOSOPHY AND EXPERIMENTAL PSYCHOLOGY

EXPERIMENTAL PSYCHOLOGY

These courses are open only to students who have had an introductory course in general psychology.

102a and 112b. **Laboratory Exercises.** (1), (2), or (3) Mr. MEYER.

103a or b. **Graphology.** The manifestation of individual characteristics in peculiarities of script. Methods of identifying individual handwriting and of discovering forgeries. A reading knowledge of either French or German is required. (2) Mr. MEYER.

105a or b. **Theory of Music.** The æsthetic laws of music. The psychological differences between primitive and highly developed music, and between European and exotic music. (2) Mr. MEYER.

106a or b. **Principles of Psychology.** Discussion of the general principles of scientific investigation. Application of these principles in the criticism of modern psychological theories and problems. (3) Mr. MEYER.

108a or b. **Abnormal Psychology.** The abnormalities of mental life resulting from inborn, pathological, or artificial causes (such as idiocy, aphasia, apraxia, somnambulism, hypnosis, etc.) and their educational, medical, and forensic significance. (3) Mr. MEYER.

109a or b. **Psychological Systems.** A comparative study of the psychological systems as found in the chief text-books on psychology issued during the last thirty years. (4) Mr. MEYER.

211a or b. **Psychological Seminary and Advanced Laboratory Work.** Critical reading of recent literature. Discussion of special problems and theories. Research work. Mr. MEYER.

PHILOSOPHY

101b. **The Logic of Science.** Prerequisite: course 1a or 1b, or a considerable amount of science. The theoretical presuppositions of scientific aims and methods. Among the topics that will be treated are: concepts of matter, energy, causation, natural law; theory of probability; limits of science; development of the problems of philosophy out of those of natural science. (2) Mr. HUDSON.

103a. **Ethical Theory.** Prerequisite: sophomore standing. An introductory study of the main problems of ethics and of the chief methods of their solution, with constant reference to the principal historic schools for illustration and interpretation. The following topics will be included: the nature of ethics as a philosophical discipline; hedonism; intuitionism; utilitarianism; self-realization; the ground of obligation; conscience; freedom; egoism and altruism; optimism and pessimism. (3) Mr. HUDSON.

104a. **History of Ancient and Medieval Philosophy from the Ionian Schools to Bacon.** Includes a careful reading of the greater part of Plato's *Republic*. (3) Mr. HUDSON.

104b. **History of Modern Philosophy from the Renaissance to the 19th Century.** The development of modern problems and systems of philosophy, with emphasis upon the interaction of philosophy with natural science. (3) Mr. SABINE.

105b. **Contemporary Tendencies in Metaphysics.** Prerequisite: course 104b or an equivalent. Representative systems, issues, and controversies of the present day; general relations to historic philosophy. Stress is laid upon the problems and tendencies characteristically modern in their setting, such as those aroused by the development of modern science. (3) Mr. HUDSON.

108a. **Philosophical Applications of Evolution.** The origin of the concept of evolution, its application outside biology, particularly in ethical theory, and its significance for metaphysics. (2) Mr. SABINE.

109a. **Philosophy in the Life of the Nineteenth Century.** Not given in 1916-17. A non-technical presentation of philosophical ideas which have played a part especially in social and political movements of the nineteenth century. Mr. SABINE.

110a. **Scientific Naturalism.** Prerequisite: course 104b or an equivalent. Materialism and other types of metaphysics that profess to depend in a special sense on the natural sciences; reading of Haeckel, Spencer, and others. (3) Mr. SABINE.

112b. **American Ideals.** A study of the metaphysical and ethical interpretations of life implied in American social and political institutions. (3) Mr. HUDSON.

230a and 230b. **Seminary.** Subject to be determined. Two or three hours' credit according to the amount of work done. Mr. HUDSON; Mr. SABINE.

GROUP OF EDUCATION

110a. **The Psychology of Learning.** Prerequisite: course 102a or its equivalent in educational psychology. This is an advanced course which undertakes to work out a science of education based upon a knowledge of the child and the laws of learning. Some of the topics considered are the development of attention, perception, and the various mental functions. Special attention will be given to the subjects of individual differences and the laws of learning as far as determined by the recent work in educational psychology. A part of the course will consist in a study of the period of adolescence. (3) Mr. PYLE.

111b. **Scientific Tests.** Prerequisite: course 102a or its equivalent. It is the purpose of this course to apply the results of psychological investigations to the problems of the schoolroom in examining and test-

ing methods of teaching, the classification and grading of pupils, the determination of individual types and capacities, and in ascertaining the characteristics of the learning process. Lectures and laboratory work. (3) Mr. PYLE.

112a. **The Abnormal Child.** A study of subnormal and supernormal children from the standpoint of genetic psychology. Examination of the causes of these deviations, tests for their determination, and a study of their proper treatment. (1) Mr. PYLE.

113a and 113b. **Current Problems.** A study of current problems in education from the point of view of psychology. Informal discussions and reports of periodical literature in educational psychology. The object of this course is to acquaint the student with present-day educational problems and give a basis and perspective for their scientific consideration. (1) Mr. PYLE.

120. **History of Education.** The purpose of this course is to give a better understanding and appreciation of present educational tendencies by tracing historically those educational movements which have been most effective in determining the present educational situation or are typical or prominent aspects of it. (2) Mr. COURSAULT.

121a. **Educational Classics.** An intensive study of the historical setting and content of a few educational classics which mark prominent movements in the development of educational thought and practice. (3) Mr. COURSAULT.

130a and 130b. **Theory of Teaching.** A general course which aims to formulate a method of class work and to illustrate, as fully as time will permit, its application to subjects in all grades of school work. (3) Mr. CHARTERS.

148. **Statistical Studies in Theory of Teaching.** Prerequisite: course 130a or its equivalent. The application of statistical methods to the improvement and testing of methods of teaching. (3) Mr. CHARTERS.

150a. **School Supervision.** A study in the principles of school supervision, in which emphasis is laid upon the relation between superintendent, supervisors, teachers, and pupils. Practical problems such as attendance, classification, government, reports, exhibits, will be briefly considered on the basis of this relation. The course consists largely of observational studies in the University schools. (2) or (3) Mr. MERIAM.

150b. **Supervision of Instruction.** A study in the principles and practice of class criticism, arranged for superintendents, principals, and supervisors in public schools and normal schools. Outlining studies, providing materials of instruction, helping pupils study, determining upon tests of efficiency are the leading problems in the course. Laboratory work, supervising in the University schools, is a part of this course. (2) or (3) Mr. MERIAM.

151. **Elementary Education.** A study is made of the function of the elementary school in modern life and the nature of the curriculum needed to meet this aim. Elementary problems of school management and current methods of teaching reading, arithmetic, geography, etc. are studied. This course is planned for those preparing for special work in teaching or supervising in elementary schools and includes much observation and laboratory work in the University Elementary School. (1), (2), or (3) Mr. MERIAM.

160b. **School Economy.** A course in effective methods of school management from the standpoint of the teacher in secondary schools. (2) Mr. ELLIFF.

161b. **School Administration.** A general treatment of the important administrative problems of principals and superintendents in small city school systems, for which the class meets twice a week. The third hour of credit will be given for individual practice work in the investigation and solution of practical problems involved in the administration of the University High School, the University Elementary School, and the Columbia Public Schools. (2) or (3) Mr. ELLIFF.

163a. **High School Administration.** Prerequisite: courses 102a and 120 or equivalent. A consideration, from the standpoint of the administrator, of the main problems now confronting secondary education in the United States, with special reference to conditions in Missouri. The principal topics considered are: relation of high school to elementary school, college, and community; organization and direction of teaching staff; equipment; government; reorganization of curriculum with special attention to vocational training, physical education, and social life of high school; elimination of pupils; keeping, interpretation, and use of high school statistics; financing of secondary education. Open for credit only to superintendents, high school principals, and experienced high school teachers. (2) Mr. ELLIFF.

170b. **Principles of Education.** The purpose of this course is to reveal the fundamental principles upon which educational procedure should rest. Such topics as the following are considered: the relation of the individual to society; the ways in which the individual acquires ideas and ideals; the development of character and of knowledge and appreciation of the world; the values of the sciences, history, literature, etc.; the nature of social development; the fundamental ideas underlying the selection of the curriculum and methods of teaching; the relation of the various points of view from which education is studied. (3) Mr. COURSAULT.

180a and 180b. **Practice Teaching.** Hours and credit must be arranged with the instructor before registration. Application should be made in the semester preceding that in which this course is wanted. Mr. MERIAM.

210. **Seminary in Educational Psychology.** The special problems selected for study will depend upon the interest of those taking the

course, the aim being to guide advanced students of education in constructive work in the theory of education through a detailed study of a few aspects of mental development. The course is open only to students who have had considerable training in both education and psychology. For thesis work. Credit to be arranged. Mr. HILL; Mr. PYLE.

211a and 211b. **Research Course in Educational Psychology.** Original investigation of problems in mental development or in any field of educational psychology. Open only to students who have had training in both general and educational psychology, including training in psychological method. Credit to be arranged. Mr. PYLE.

220. **Seminary in the History of Education.** A critical investigation of topics in connection with the thesis work for the graduate degrees. Mr. COURSAULT.

221b. **History of Education in the United States.** A research course for advanced students. (2) Mr. COURSAULT.

230. **Seminary in Theory of Teaching.** An intensive study of some problems in theory of teaching. The problems selected will depend in part upon the interests of the students. Considerable use is made of psychology and history of education, satisfactory work in both being prerequisite to this course. (3) Mr. CHARTERS.

231. **Research Course in Theory of Teaching.** An intensive study of certain problems in theory of teaching, the selection of which is largely dependent upon the interest of the class. Primarily for students not in residence who are working upon special problems. Credit to be arranged. (3) Mr. CHARTERS.

250. **Seminary in School Supervision.** An intensive study of problems in connection with thesis work for graduate degrees. Opportunity is offered for experimental work in the University schools. Mr. MERIAM.

251. **The Public School Curriculum.** Research work on courses of study for elementary schools and for high schools. A close examination is made of typical curricula in schools of this country and foreign countries; also curricula of special schools. Study is made of the development of the curriculum to meet changing social and industrial conditions in community and national life and to comply more adequately with the psychological development of the pupil. (3) Mr. MERIAM.

260b. **Seminary in School Administration.** A research course in school organization and administration with special reference to city school systems. The course is to be taken only in connection with thesis work for the graduate degrees. Mr. ELLIFF.

270. **Seminary in Philosophy of Education.** An intensive study of problems in the philosophy of education in connection with thesis work for the graduate degrees. Mr. COURSAULT.

271. **Philosophy of Education.** This course begins with a critical study of the origin and nature of some of the traditional fundamental beliefs that seriously affect the consideration of educational problems and

leads to a systematic treatment of the fundamentals of education in the light of modern science and philosophy. The ideas acquired are then used in the interpretation and criticism of a variety of modern contributions to educational thought and practice. (3) Mr. COURSAULT.

In addition to the above, a number of courses in the teaching of Botany, English, German, etc., and in the administration of school subjects are offered and may be counted as education for the degree of Master of Arts.

For a statement of these courses, see the announcement of the School of Education in the general catalogue.

GROUP OF HISTORY AND POLITICAL SCIENCE

ECONOMICS

105a and 105b. **Money, Credit, and Banking.** A study of the relation of the production of the precious metals and the banking business to the supply of money and the prices of commodities. An inquiry is also made into the organization and operation of the banking business in the leading nations with special reference to its bearing on loan and discount rates and the development of business. (5) Mr. STEWART.

106a. **American Transportation Problems.** The theory of rate making, competition of transportation lines, transportation monopoly, discriminations and their effects, and rate regulation. Particular attention is devoted to leading decisions of the Interstate Commerce Commission. (3) Mr. BROWN.

107a. **Economic History.** The American people in their advance from the simple economic life of colonial days to the complex activities of the present; the development of industry, commerce, transportation, finance, money and banking, and labor organization. The economic movements in other countries will be considered wherever they have had important influence on American development. (5) Mr. ARDZROONI.

108a or b. **Insurance.** The general principles, the different forms of personal and property insurance, and the main problems connected with each. (2) See Mathematics, course 155a or b.

110a or 110b. **Problems of Labor.** A study of the special problems and interests of wage-earners, such as the organization and policies of trades-unions, employers' associations, arbitration, profit-sharing, factory acts, and other forms of labor legislation. (3) to (5) Mr. ARDZROONI.

115a or b. **Public Revenues.** A critical examination of (1) the various theories as to the limits of state activity; (2) various ethical systems as related to the problem of justice in taxation; (3) proportional vs. progressive taxation; (4) the later developments in value theory as bearing on the more difficult problems of incidence; (5) the administrative aspects of income taxation; (6) ethical, legal, and con

stitutional aspects of franchise and corporation taxation; (7) the practicability of a scientific articulation of the various taxes under American conditions. (3) to (5) Mr. DAVENPORT.

117a and b. **Accounting.** The construction and interpretation of the accounts of the private business, the partnership, and the corporation. A study of the use of the income account and balance sheet in connection with the capitalization and valuations of property, and the relation of cost accounts to business and industrial efficiency. Laboratory work in bookkeeping. (3) to (5) Mr. SCOTT.

118a. **Corporation Finance.** Describes the purposes and methods pursued in the organization and management of business corporations and the uses and character of corporation securities as related to the investors and to the corporation's management. (2) Mr. VEBLEN.

119b. **Trusts and Combinations.** Treats of the development of business organizations, the financing of such enterprises, their relations to the control of industry, the prices of commodities, and the distribution of wealth. (3) to (5) Mr. VEBLEN.

120a or b. **Accounting and Business Policy.** An intensive study of cost accounting methods together with a summary review of the balance sheet and income statement, leading to the analysis and interpretation of annual reports of industrial corporations with a view to showing how they may be made the guide to sound business policies. (3) Mr. SCOTT.

121b. **Speculative Markets.** The organizations, methods, and functions of produce exchanges and securities markets and the influence of their operations upon the movement of prices. (2) or (3) Mr. STEWART.

209b. **Crises and Depressions.** The recurring periods of activity and inactivity in business known as prosperity, crisis, and depression. The causes and effects of these fluctuating movements are sought by an analytical study of recent business cycles. (2) Mr. STEWART.

210a and 211b. **Advanced Economic Theory.** A critical examination of the writings of the leading economists from the time of Adam Smith to the present, to the end of constructing a correct theory of value and distribution. A survey of the theoretical aspects of the science. Credit to be arranged. Mr. DAVENPORT.

212. **Seminaries.** Credit to be arranged. Mr. DAVENPORT; Mr. VEBLEN; Mr. STEWART.

213a or b. **Statistics.** The rudiments of statistical methods based upon a study of sources and collection of statistical data, census reports, forms of averages and their proper uses, together with the graphic and tabular presentation of results. (3) See Mathematics, course 160b.

214a and 215b. **History of Economics.** A first-hand study of authors and documents, with especial reference to the background of political and industrial conditions and of philosophical thought. The student is

advised to correlate this course with related courses in philosophy, political science, history, and sociology. (2) or (5) Mr. VEBLEN.

218a and 219b. **Economic Factors in Civilization.** An inquiry into institutions as affected by economic conditions with a view particularly to early European civilization. (2) to (5) Mr. VEBLEN.

232a or b. **Radical Economic Reforms.** A consideration of the essential features of the early nineteenth century radical economic thinking. An examination will be made of some of the writings of representatives of early socialistic thought—particularly of Karl Marx and leaders of French and German socialism. A study of the syndicalist movement both abroad and in the United States with special attention to recent radical tendencies in American politics. (3) Mr. ARDZROONI.

233a or b. **Valuation of Public Utilities.** A study of economic principles, legal precedents, and administrative authorities, as bearing upon public valuation, for purposes of (a) taxation, (b) the fixation of rates and charges, (c) the terms of public appropriation. Collateral with course in engineering covering engineering theory and practice in the same field. (3) Mr. DAVENPORT.

HISTORY

105a. **Greek History.** (3) Mr. OLMSTEAD.

106b. **Roman History.** (3) Mr. OLMSTEAD.

These two courses, tho they may be taken separately, together give a survey of general Ancient History. They are intended for mature students, especially prospective teachers.

110a. **The Renaissance and the Protestant Revolt.** A general survey of the period from 1300 to 1600. (5) Mr. TRENHOLME.

115b. **Recent European History.** The political, social, economic, and institutional history of the chief European countries since 1815 will be carefully studied with a view to present conditions. (5) Mr. KERNER.

130a. **Oriental History (to 600 A. D.).** Not given in 1916-1917. Political and social history of the early Oriental peoples of Assyria, Babylonia, Egypt, and Israel; Greece and Rome in their relations with the Orient. (3) Mr. OLMSTEAD.

131b. **Oriental History (600-1900).** Not given in 1916-1917. A study of the political and social aspects of the rise of Islam with special emphasis on the relations between Western Asia and Europe. (3) Mr. WRENCH.

The two preceding courses, though they may be taken separately, together form a complete survey of the history of Western Asia.

135b. **History of the Hebrews.** Not given in 1916-17. The sources for Old Testament History, the religious and social development, the background for Christianity, and the later Judaism. (2) Mr. OLMSTEAD.

148a. **The Roman Empire.** Not given in 1916-17. History of Rome during the early empire with special reference to the provinces. (2) Mr. OLMSTEAD.

150a. **European Culture and Civilization—the Middle Ages.** A careful study of the blending of the Graeco-Roman, German, and Christian elements of culture during the early medieval period and their later development. (2) or (3) Mr. WRENCH.

155b. **The Crusades.** A course dealing in an intensive way with the crusading movement in both its western and eastern aspects. (2) or (3) Mr. WRENCH.

157b. **Later Roman Empire.** Not given in 1916-17. A study of the political, economic, and social development of the Roman Empire from the age of Justinian to 1453. (2) Mr. WRENCH.

160a. **The French Revolution and the Napoleonic Era.** Lectures, with discussion, based on text and collateral reading, on the political history of the period. (3) Mr. KERNER.

163a. **Modern Germany and Austria-Hungary.** Not given in 1916-17. History of the German people under the Hapsburgs and Hohenzöllerns from the Reformation to the present time. (2) Mr. KERNER.

165b. **Modern Russia.** A survey of the political, social, and economic evolution of the Russian empire and its relations to Pan Slavism. Lectures, collateral reading, class discussions. (3) Mr. KERNER.

167b. **The Far Eastern Question.** Not given in 1916-17. The modern history of China, Japan, and India, with especial reference to their relations with Europe. (2) Mr. KERNER.

170a. **Modern England.** A course dealing with the internal and external problems of England and the British Empire since 1660. (3) Mr. TRENHOLME.

175b. **English Constitutional History.** An advanced English history course dealing with the growth of English government and law as a background to present conditions in the British Empire and America. (3) Mr. TRENHOLME.

180b. **American Social History.** A survey of the development of American society, with emphasis on the economic and social progress since the Revolution. (2) Mr. STEPHENS.

182a. **History of the West.** A study of the westward movement of population, the economic, social, and political development of the west, and the reaction of western ideals and influences on United States history. (3) Mr. VILES.

184b. **History of the South.** Economic, social, and political development of the South. The agricultural system, with its dependence upon unfree labor and the resulting political theories, will make up the background of the course. (2) Mr. STEPHENS.

186b. **History of Missouri.** The primary aim of this course will be to give an account of the development of Missouri since 1803. (2) Mr. VILES.

190a. **American Diplomatic History.** A comprehensive view of the foreign relations of the United States, with Fish, *American Diplomacy* as a text. (3) Mr. STEPHENS.

195b. **Recent United States History.** History of the United States since 1876, from the point of view of the historical background of present day problems. (3) Mr. VILES.

210. **Seminary in Historical Research and Thesis Work.** A course giving opportunity for research and thesis work along special lines. Primarily intended for candidates for graduate degrees. The work of the student will be under the direction of the instructor most interested in the field in which the topic of special research lies. (1), (2), (3), or (4)

240. **Seminary in Ancient History.** (2) or (3) Mr. OLMSTEAD.

260. **Seminary in English Constitutional and Legal History.** A graduate research course in English constitutional and legal history. (3) Mr. TRENHOLME.

280b. **Seminary in American Political Government and History.** Not given in 1916-17. The development of political parties, 1815 to 1840, with especial attention to the social and economic factors and to the political leaders. (2) or (3) Mr. VILES.

286. **Seminary in Missouri History.** Research in selected topic in Missouri history, 1820-1845. (3) Mr. VILES; Mr. STEPHENS.

POLITICAL SCIENCE AND PUBLIC LAW

102b. **Elementary Law.** An introduction to the study of law. The nature, sources, and classification of law with a general survey of the field of private law. (3) Mr. LOEB.

104a. **European Governments.** A descriptive study of the constitutional organization and practical working of the principal governments of Europe, with considerable attention to political parties and current political questions. (3) Mr. SHEPARD.

105b. **Comparative Constitutional Law.** A comparative study of the legal and theoretical basis of the modern state, the various forms of government and the structure and function of the principal governmental organs. (3) Mr. SHEPARD.

106a. **Municipal Government.** A comparative study of the organization, functions, and administration of cities of Europe and the United States. During the latter part of the course special topics will be taken up in more detail, such as: central control over cities, municipal elections, municipal revenue, the regulation of public utilities, and municipal ownership. (2) Mr. LOEB.

107a. **Party Government.** Not given in 1916-17. A study of the theory, organization, methods of action, and functions of political parties, with special emphasis on the party system of the United States. (2) Mr. SHEPARD.

108a. **State Administration.** A study of the development, organization, and functions of the executive branch of the American state governments, with special emphasis on the newer administrative agencies and the relation of the state government to contemporary economic and social problems. (2) Mr. JOURNEY.

109b. **International Law.** A general treatment of the law governing international relations, with considerable attention to the problems arising out of the European war. (3) Mr. SHEPARD.

201a. **Colonial Government.** Not given in 1916-17. A study of the present government and administration of the colonies of the United States and of other countries. (3) Mr. SHEPARD.

204. **Constitutional Law of the United States.** Particular attention will be given to the field of individual liberty defined in the Constitution of the United States and interpreted in the decisions of the Supreme Court. (3 and 2) Mr. LOEB.

208b. **The Government of Missouri.** Not given in 1916-17. A study of the constitutional development of the state from the Louisiana Purchase to the present time, followed by a consideration of the organization and functions of the institutions of the central and local governments. (2) Mr. LOEB.

209b. **The Law of Taxation.** Not given in 1916-17. A study of the legal rules regulating taxation in the central and commonwealth governments of the United States. The student is advised to correlate with related courses in economics. (2) Mr. LOEB.

210. **History of Political Theories.** A study of the development of political thought in its relation, as cause and effect, to political action, from the period of antiquity to our own day. (2) Mr. SHEPARD.

212. **Proseminar—The Electorate.** An intensive study of the organization and functions of the electorate from a comparative point of view. (3) Mr. SHEPARD.

220. **Seminary.** Credit to be arranged. Mr. LOEB; Mr. SHEPARD.

SOCIOLOGY

110a. **Social Pathology.** A study of the origin, nature, and treatment of the dependent and defective classes. As causes of poverty and degeneracy are studied physical and mental abnormalities, the unequal distribution of wealth, low wages and standards of living, unemployment, etc. As remedial and preventive agencies are studied educational and legislative measures, social reform movements, eugenics, public and private relief, organized charity, almshouses and other institutions for dependents and defectives, etc. Lectures and assigned reading. (3) Mr. BERNARD.

111b. **Criminology.** A study of the causes, nature, and treatment of crime. Among the topics treated are criminal statistics, the social

and personal causes of crime, female and juvenile criminality, the reform of criminal procedure, prison systems and the county jail, the industrial reformatory, the indeterminate sentence, prison labor, probation and parole, the treatment of the juvenile offender. Lectures and assigned reading. (3) Mr. BERNARD.

112a. Preventive Philanthropy. An intensive study of some specific problems in preventive work, including a study of child problems, playgrounds, child labor, and the juvenile court. (2) Mr. HANDMAN.

115a and b. Rural Sociology. A study of social conditions in rural life and their improvement. Among the topics considered will be the statistics and movements of rural population, the physical environment of rural life, isolation and means of communication, rural occupations, co-operative organizations among farmers, the family and woman's position in rural life, the country school, the country church, leadership, etc. Lectures, assigned reading, and papers. (2) Mr. BERNARD.

116b. Urban Sociology. A study of social conditions in urban communities. The origin and growth of cities will be considered. An intensive study will be made of educational, political, moral, social, aesthetic, and religious forces and institutions in urban life. Municipal reform movements will be considered. Lectures, assigned reading, and papers. (2) Mr. HANDMAN.

125a. General Anthropology. A study of the origin and evolution of man as an animal and of the different races of mankind. The prehistoric human types, and the characteristics of the Negro, Mongolian, American, and Caucasian races. Lectures and assigned reading. (3) Mr. ELLWOOD.

126b. Cultural Anthropology. A study of social origins and of the earliest stages in cultural evolution; the stone and metal ages, the origins of industry, language, magic, religion, morals, science, art, and of social organization in the family, horde, clan, and tribe. Lectures and assigned reading. (3) Mr. ELLWOOD.

220a. The Principles of Sociology. A critical study of sociological theory. The sociological theories of recent writers, such as Ward, Ross, Giddings, and Hobhouse, will be critically examined with a view to laying the foundations for a constructive theory of the social life in modern biology and psychology. Discussions and papers by the class. (3) Mr. ELLWOOD.

221b. Biological Sociology. A course on the biological basis of sociology. Among the topics treated will be the relation of organic to social evolution with special attention to heredity, selection, adaptation, and variation, the beginnings of social evolution in the animal world, and the instinctive, emotional, and intellectual forces for association. Lectures, assigned reading, and research work. (2)

222a. Social Statistics. Statistical methods for the investigation of problems in social science will be studied. The principal statistical

investigations that have so far been made will be analyzed and one or more problems will be given to each student to furnish practice in quantitative treatment. Lectures, assigned reading, and research work. (2)

226. **Ethnic Psychology.** Not given in 1916-17. A study of the comparative psychology of races as shown in their customs, institutions, and social organization.

227a. **The Negro in America.** A study of the social, economic, moral, and educational conditions among the negroes of the United States. The work will consist of lectures, library work, and theses. Students will be admitted only after consultation. (3)

230b. **History of Social Philosophy.** Lectures on the development of social thought from Aristotle to the present. The social philosophies of Plato, Aristotle, St. Augustine, Thomas Aquinas, Machiavelli, Bodin, Hobbes, Locke, Vico, Montesquieu, Rousseau, Condorcet, and the sociological systems of Comte, Spencer, Shaeffle, Lilienfeldt, Gumpłowicz, Ratzenhofer, and Ward will, among others, be considered. A large amount of assigned reading will be required in this course. The student is advised to correlate this course with related courses in economics, history, political science, and philosophy. (3) Mr. ELLWOOD.

231a. **History of Philanthropy and the Poor Law.** A study of the development of legislation governing and methods of administering public relief in England and America, and the parallel account of voluntary charitable institutions and methods. (2)

232a or b. **Radical Economic Reforms.** See Economics, course 232.

240. **Seminary.** Research work upon special problems in sociology and philanthropy. Two, three, or four hours' credit will be given according to the amount of work. Mr. ELLWOOD; Mr. BERNARD.

GROUP OF MATHEMATICAL AND PHYSICAL SCIENCES

ASTRONOMY

102a and 103b. **Practical Astronomy.** An introduction to the theory and application of astronomical instruments. Use of ephemerides. (3) Mr. BAKER.

105b. **Modern Astronomy.** A study of the problems and aims of modern astronomical science; its relation to other sciences. Frequent references to current literature of astronomy. (3) Mr. BAKER.

106a and b. **Advanced Astronomy.** Subjects are selected to meet the requirements of the individual students. Credit to be arranged. Mr. BAKER.

108b. **Theoretical Astronomy.** Integration of equations of motion. Determination of parabolic and elliptic orbits; construction of ephemer-

ides. Application to comets, planets, and binary stars. Credit to be arranged. Mr. BAKER.

209a. **Astrophysics.** The application of physical principles to astronomy. Methods and results, with their bearing on solar and stellar phenomena. Studies in photometry and radial velocity. (3) Mr. BAKER.

210b. **Stellar Photometry.** Theory and use of photometric apparatus. Investigation of stellar magnitudes and their variation, by visual and photographic methods. (3) Mr. BAKER.

220. **Research.** Opportunity for original investigation is offered to qualified students.

CHEMISTRY

101a and b. **Advanced Inorganic Chemistry.** Prerequisite: courses 27a or b and 111, qualitative analysis and organic chemistry. Lectures and recitations on the chemistry of the metallic elements. Additional credit may be obtained in this course by arranging for laboratory work. (3) Mr. MARDEN.

111. **Organic Chemistry.** Lectures, recitations, and laboratory work. (3) Mr. CALVERT; Mr. CONRAD; Mr. WRIGHT.

112a. **Preparation of Organic Compounds.** A laboratory course in synthetic organic chemistry. May be taken with course 111. (2) or (3) Mr. CALVERT.

113b. **Preparation of Organic Compounds and Organic Analysis.** Laboratory course. (3), (4), or (5) Mr. CALVERT.

121. **Quantitative Chemical Analysis.** The general principles of gravimetric and volumetric analysis. Laboratory work and lectures. (3) Mr. GIBSON.

122a. **Technical Analysis.** Prerequisite: course 121. Gas, water, and fuel analysis. Required of chemical engineers. (3) Mr. GIBSON.

123b. **Technical Analysis.** Prerequisite: course 121. The analysis of commercial products of an inorganic character. (3) Mr. GIBSON.

125a. **Quantitative Organic Analysis.** Must be preceded or accompanied by course 121. Quantitative analysis of commercial organic products, such as alcohols, aldehydes, organic acids, glycerine, oils and fats, carbohydrates, petroleum products, soaps, etc. (3) Mr. CALVERT.

126b. **Quantitative Organic Analysis.** A continuation of course 125a. (3) Mr. CALVERT.

127a or 127b. **Advanced Qualitative Analysis.** Prerequisite: course 27a or b. The complete qualitative analysis of rocks, minerals, slags, and alloys. (2) Mr. GIBSON.

128a or 128b. **Advanced Qualitative Analysis.** Prerequisite: course 127a or 127b. The qualitative detection of some of the less common elements and the qualitative analysis of inorganic commercial products. (2) Mr. GIBSON.

131. Physical Chemistry. Prerequisite: course 111. Stoichiometry of gases, liquids, and solids; solutions and the theory of ionization; thermo-chemistry; the phase rule; chemical equilibrium. Lectures or recitations (two), laboratory (one), (two), or (three), according to amount of laboratory work elected. (3), (4), or (5) Mr. SILL.

133. Electro-chemistry. Prerequisite: course 111; Physics, course 3. Lectures, recitations, and laboratory work in eletro-chemical measurements. Lectures (two); laboratory. According to amount of laboratory work elected. (3), (4), or (5) Mr. SILL.

135a or 135b. Radioactivity. Prerequisite: undergraduate courses in physics and chemistry. Lectures, recitations, and laboratory work on the radioactive types of matter and atomic disintegration. (3) Mr. SCHLUNDT.

141a. Industrial Chemistry. Prerequisite: course 27a or b, and 111, Organic Chemistry. Lectures and recitations on the application of chemistry to the purposes of human life as illustrated in the more important arts and industries having a chemical basis for their principal operations and processes. Fuels, water, acids, fertilizers, cements, glass, pottery, paints, gas, explosives, metals, alloys, etc. Additional credit may be obtained in this course by arranging for laboratory work. (3) Mr. BROWN.

142b. Industrial Chemistry. Prerequisite: same as for course 141a. Starch, glucose, sugar, fats, oils, soaps, dyes, and other industries. Lectures and recitations. (2) or (3) Mr. BROWN.

151a or 151b. History of Chemistry. Prerequisite: courses 111 and 131. May be taken along with course 131. (3)

200. Chemistry of the Rare Earths. Prerequisite: course 121. Lectures, recitations, and laboratory work on the occurrence, distribution, properties, and uses of the rare earths. (3) Mr. BROWN.

211a and 212b. Advanced Organic Chemistry. Prerequisite: course 111. Lectures on selected topics, supplemented by reading and reports on classical researches. (2) or (3) Mr. CALVERT.

221. Advanced Quantitative Analysis. Prerequisite: course 121. Chiefly laboratory work. The complete quantitative analysis of rocks, ores, minerals, slags, and various commercial materials and products. The work of the course will be varied to meet the needs of the individual. Credit to be arranged. Mr. GIBSON.

232a and 232b. Advanced Physical Chemistry. Prerequisite: courses 131 and 121. Lectures on selected topics, supplemented by reading and reports on classical researches. A reading knowledge of German and French is very desirable. Credit to be arranged. Mr. SCHLUNDT.

260. Seminary. Meetings at which subjects of chemical interest are discussed by students of sufficient attainment and members of

the teaching staff. A reading knowledge of French and German is desirable. (1)

271. Research. Research is offered in this department in the following lines of work: inorganic, organic, physical, analytical, radio- and electro-chemistry, and micro-metallography. Arrangements for research work should be made by consultation with the instructor with whom the work is elected.

The University of Missouri Section of the American Chemical Society meets monthly for reports on current literature and researches in progress in the University. Students are invited to be present.

GEOLOGY, MINERALOGY, AND GEOGRAPHY

GEOLOGY AND MINERALOGY

100a. Economic Geology. Prerequisite: course 1a or 1b or 2a or 2b; also course 108b or 106a if taken as graduate work. Deals with coal, oil and gas, clays, building stones, cement materials, gypsum, fertilizers, and various minor products. Their geographic distribution, mode of occurrence, uses, origin, and conservation are studied. The department has a good collection of these products which are studied in the laboratory. Field trips to mines and quarries near Columbia are made. (3) Mr. TARR.

101b. Economic Geology. Prerequisite: course 1a or 1b or 2a or 2b, and elementary chemistry; also courses 106a and 108b if taken as graduate work. Designed to give the student a general knowledge of the deposits of gold, silver, copper, iron, lead, zinc, aluminum, and minor metals. Their geographic distribution, mode of occurrence, origin, uses, production, and conservation are studied. The department has good collections of ores from the larger mining camps, and these are studied in the laboratory. (3) Mr. TARR.

102a. Advanced Physiography. Prerequisite: course 1a or 1b or 2a or 2b. A lecture, text-book, and conference course intended for those who wish to do advanced work in geology and for those who expect to teach physiography in secondary schools. The method will be topical and considerable reading will be required. (3-5) Mr. PARKINS.

103b. Historical Geology. Prerequisite: course 1a or 1b. Considers briefly hypotheses for the origin of the earth and, more fully, principles of sedimentation, distribution and kinds of rocks of each geologic period, geographic changes of the North American continent and causes for geographic changes, and incidentally the climate and life of each period. Several field trips are made for the study of the strata in northern Missouri. (3) Mr. BRANSON.

104a. Geologic Life Development. Prerequisite: course 5b or 1a or 1b and a course in zoology. Considers the changes that have taken place in the life of the earth from its first appearance to the present and

the causes for these changes. The life of each geologic period is considered as a whole and in its relation to the life of the preceding and following periods. In the laboratory, students examine specimens that illustrate the gradual evolution toward living types. (3) Mr. BRANSON.

105. Field Course. Prerequisite: 5 hours of geology. Offered in the summer session. Intended as preparatory for advanced work in geology and as a basis for the teaching of geology and physical geography. The field work will consist of mapping the areal geology, describing the sedimentary formations, igneous and metamorphic rocks, collecting in a systematic way from the formations, and reporting on the structural geology, physiography, and economic products of a small area south of Yellowstone National Park in Wyoming. A more general study will be made of a large area in Wyoming. Special topics are assigned to graduate students, and this work may form the basis for masters' or doctors' theses. (8) Mr. BRANSON.

106a. Mineralogy. Prerequisite: course 1a or 1b or 2a or 2b. A study of the elements of crystallography, based upon lectures and work with models and crystals. This is followed by lectures on the physical and chemical properties of minerals with detailed descriptions of their mode of occurrence, geographic distribution, and origin. The laboratory work is designed to give the student the methods of determinative mineralogy. After a few weeks preliminary preparation with the elements, unknown minerals are given the student for determination. The student is expected to become familiar with about 200 common minerals. (5) Mr. TARR.

107b. Petrology. Prerequisite: courses 108b, 106a; inorganic chemistry; and general physics. The principles of optics, as applied to the polarizing microscope, and the optical properties of the rock-forming minerals are first studied. This is followed by microscopic and megascopic study of the various rock groups. (5) Mr. TARR.

108b. Rocks and Rock Minerals. Prerequisite: course 1a or 1b or 2a or 2b. A study of the various kinds of common rocks and of the minerals that constitute them. A field classification is followed in the laboratory and the methods pursued are those which would be used in the field. The lectures deal with the origin, geologic features, economic properties, and weathering of rocks. The course is designed for all those who wish a general knowledge of rocks as well as for geologists, engineers, architects, agriculturists, etc. (3) Mr. TARR.

200a. Principles of Ore Deposits. Prerequisite: courses 108b, 106a, 100a, and 101b; Chemistry, course 6a; and general physics. A consideration of the origin of the deposits of the metals and nonmetallic minerals, the principles and chemistry of their deposition, and their metamorphism. (3) or (4) Mr. TARR.

202a. Stratigraphic Geology. Prerequisite: courses 103b and 104a. Lectures, map work, and field work on the stratigraphy of North

America, with more intensive study of a limited area. (5) Mr. BRANSON; Mr. GREGER.

203b. **Paleontology.** Prerequisite: course 104a. Zoology of invertebrates and comparative anatomy of vertebrates are desirable antecedents. A somewhat detailed study of a few of the main groups of invertebrates or vertebrates with reference to their evolution and distribution previous to the present period. The content of the course will be varied to suit the needs of individual students. (5) Mr. BRANSON; Mr. GREGER.

204. **Seminary.** Geological literature and history. (1-2) Mr. BRANSON; Mr. TARR.

205. **Research Work.** Offered by members of the department in their respective lines.

GEOGRAPHY

109a. **Geographic Literature.** Prerequisite: course 1a or 1b and 6a. A reading course for students capable of doing semi-independent work. Reading may be along several lines, pedagogical, regional, economic, historical. Written reports required. (3-5) Mr. PARKINS.

110b. **Geography of North America.** Prerequisite: general college geography or principles of geology. Physical features, climate, plant life, animal life, and mineral resources of the continent; and their influence on the distribution of population, localization and development of industries, development of transportation, growth of cities and the historic development of the various countries. (3) Mr. PARKINS.

MATHEMATICS

It is especially recommended that students intending to specialize in mathematics should take courses in French and German in the preliminary work; but an extensive knowledge of the literature of those languages is not necessary.

The courses past course 100 are open only to those who have secured the permission of the instructor in the course.

100a and 101b. **Second Course in Calculus.** This course should be elected by all who have reasonably succeeded in elementary calculus, who desire to continue mathematical work. It will deal with questions necessarily omitted or treated hurriedly in the first course on calculus and will cover approximately the ground indicated by Goursat-Hedrick, *Course in Mathematical Analysis*, including also introductory lectures on sets of points. (3) Mr. AMES.

105a and 105b. **Advanced Algebra.** Prerequisite: course 3 and 4. This course will include determinants, theory of equations, and applications of algebra to geometry. (3) Mr. DUNKEL.

110a and 115b. **The Historical Development of Mathematics.** Designed as an introduction to higher courses in mathematics and as a comprehensive view of the whole subject for students who will not pursue mathematics farther. It will consider the main problems, the point of view, and the methods of the principal higher divisions of mathematics, together with an intensive study of typical topics selected from a wide range. The treatment of any topic will be accompanied by a consideration of the larger significant facts in the history of its development. While the two courses, 110a and 115b, form essentially one course, the latter is so arranged that it may, by special permission, be elected independently of course 110a by suitably prepared students. (3) Mr. AMES.

120a and 125b. **Differential Equations and their Applications.** A short time will be spent in the consideration of differential equations and in the formal solution of some of the simpler types. This will be followed by the careful study and solution of certain problems of geometry, physics, and other sciences in which differential equations occur. Course 125b is so arranged that it may, by special permission, be elected independently of course 120a by specially prepared students. (3) Mr. HEDRICK.

150a and 151b. **Graphical Analysis.** Graphical computations, such as construction of rational functions, solution of differential equations, construction of graphical tables, and a treatment of certain topics of analysis. (1)

155a or b. **Mathematics of Business and Insurance.** Prerequisite: course 8 or its equivalent. The fundamental methods and computations involved in annuities, depreciation, sinking funds, stock and bond calculations; special attention to the theoretical and mathematical aspects of the different phases of insurance. (3) Mr. WESTFALL.

160a or b. **Probabilities and Statistics.** Fundamental elementary topics in the theory of probabilities, including the theory of least squares, statistical methods, applications and illustrations from social and biological sciences, with assignment of special problems to suit the need of the student. (3) Mr. WESTFALL.

200a or b. **Seminary.** The members of the staff will conduct work in reading and research in private with students prepared for such work. The nature and amount of the work done may vary materially. The course may be elected repeatedly in different semesters for different work and for any number of hours sanctioned by the instructor.

205a or b. **Modern Algebra.** The nature of the course is best indicated by such reference books as Weber's Algebra and Bocher's Higher Algebra. (3) Mr. DUNKEL.

210a or b. **Differential Geometry.** Naturally follows either course 101b or 125b. Introduction to the theory of modern differential geometry. Reference books: Eisenhart; Joachimstahl; Wilczynski; Bianchi. (3) Mr. INGOLD.

215a or b. **Projective Geometry.** Lectures, supplemented by reading. Reference books: Emch; Veblen and Young; Reye; Scott. (3) Mr. INGOLD.

220a or b. **Fourier's Series and Allied Series.** Introduction to mathematical physics. Lectures, supplemented by reading. (3) Mr. KELLOGG.

225a or b. **Potential Function.** Continuation of course 220a. Properties of potential functions; boundary value problems; and applications. Lectures, supplemented by reading. (3) Mr. KELLOGG.

230a and 231b. **Theory of Functions of Real Variables.** Higher analysis, including the most important features of mathematical analysis. Lectures, supplemented by reading. (3) Mr. HEDRICK.

240a and 241b. **Theory of Functions of Complex Variables.** Alternate years. Not given 1915-16. Theories of Riemann, Cauchy, and Weierstrass, in their elementary phases. Theory of functions of a complex variable; elliptic functions. (3)

251a or b. **Seminary in Actuarial Science.** Advanced investigations in actuarial and allied problems. Hours to be arranged. Mr. WESTFALL.

260a or b. **Theory of Groups, with Application to Galois' Theory and Lie's Theory.** Lectures. (3)

280a or b. **Calculus of Variations.** Theory of maxima and minima for functions defined on a general range. Emphasis is laid on the applications. References to Hadamard, Bolza, and other treatises. (3)

The following courses are offered occasionally, when the needs of the student seem to warrant:

235a and 236b. **General Theory of Functions.** (3)

255a or b. **Theory of Differential Equations.** (3)

265a or b. **Theory of Numbers.** (3)

270a or b. **Analytical Mechanics.** (3)

275a or b. **Partial Differential Equations of Mathematical Physics.** (3)

Mathematical Clubs. The students of the department conduct, for the discussion of mathematical topics, a club to which all persons interested are eligible. The members of the staff of the department hold regular meetings for the discussion of current literature and of recent research, which are open also to qualified graduate students.

For other courses on mathematical topics, see also the announcements of Physics and of the School of Engineering.

PHYSICS

Students intending to specialize in physics should also take mathematics. Even in the less mathematical courses some knowledge of calculus is of great advantage.

104a. Electrical Measurements. Two lectures and three laboratory periods. In the lectures is given an introduction to the mathematical theory of electricity and electrical measurements. The laboratory work consists of such work as comparisons of resistances by Kelvin double bridge and Carey Foster methods; determination of temperature coefficients; comparison of electromotive forces of cells; various uses of the potentiometer; comparison and absolute measurement of capacities; measurement of the coefficient of self and mutual induction; calibration of ammeters and voltmeters; photometric work with incandescent lamps. (3), (4), or (5) Mr. RENTSCHLER.

The following three courses consist entirely of laboratory work. Any one of them must be preceded either by courses 1 and 2b or by 3a and 4b. They offer training in the more exact methods of laboratory measurements:

106a. Mechanics and Heat. In mechanics, angular motion, acceleration of gravity, conservation of momentum, moment of inertia, elasticity, etc. are studied; in heat, such things as specific heats, heats of combustion, vapor densities, and different methods of measuring high and medium temperatures. Work in mechanics or in heat, or in both, may be selected to suit the individual needs of the student. (1) or (2) Mr. REESE.

107a and b. Electricity. This course is much the same as the laboratory work in course 104a. (1), (2), or (3) Mr. RENTSCHLER.

108b. Light. Measurements of wavelengths by interference methods, determinations of refractive indices, study of polarization and the resolving power of optical instruments, etc. (1) or (2) Mr. REESE.

109. Advanced Work in General Physics. This course, largely laboratory work, will be adapted to meet the needs and attainments of individual students. A student may be assigned a definite problem, the literature of which must be studied and the experimental work performed with the care of original research. (2), (3), or (4) Mr. STEWART; Mr. REESE; Mr. RENTSCHLER.

110b. Electricity and Magnetism. This course is not mathematical in the same sense as courses 205-221; still it contains some theoretical work. Students desiring laboratory work in connection with this course can elect one or two hours of course 107. Lectures and recitations. (3) Mr. RENTSCHLER.

112a. Heat. (3) Mr. CORNELIUS.

113b. Light. (3) Mr. REESE.

These courses are open to those who have completed course 3a and 4b or the equivalent. Recommended to those who either intend to teach in high schools or desire work more general in character and less mathematical than courses 205, 206, 207, and 215. The work is largely descriptive but contains some theoretical work in which an elementary knowledge of calculus is desirable though not essential. The

course in heat includes some thermodynamics, one of the fundamental branches of physics. Students desiring laboratory work in connection with these courses may elect one or two hours from course 108b or 106a.

117b. **Spectroscopy.** Open to those who have had courses 1 and 2b or courses 3a and 4b. A practical course in the use of various forms of spectroscopes and the applications to physical problems. (2) Mr. REESE.

118a or b. **X-rays and High-frequency Currents.** Prerequisite: 8 hours of physics. In the lectures are discussed in a nonmathematical manner the phenomena of vacuum discharges, cathode rays, positive rays, thermions, and the production of high-frequency currents. In the laboratory the students take up the experimental study of the phenomena discussed in the lectures, the practical operation of X-ray apparatus, and the production of high-frequency currents. (1) Mr. RENTSCHLER.

121b. **Electrical Waves.** Theory and applications. (2) Mr. STEWART.

Courses 205, 206, 207, and 215 are courses in mathematical physics:

205. **Theory of Light.** Based on Drude's *Theory of Optics*. Special attention is given to the electromagnetic theory. Lectures and recitations. (3) Mr. STEWART.

207. **Theory of Electricity and Magnetism.** Lectures and recitations. (3) Mr. STEWART.

Courses 205 and 207 will not both be given in the same year.

206. **Thermodynamics.** Lectures on the classical thermodynamics with its application to the theory of heat radiation and certain branches of physical chemistry and electricity. The more modern views, based on atomic theories, are also taken up, and the student is introduced to statistical mechanics. Differential and integral calculus are prerequisite, and an understanding of the more general principles of mechanics is desirable. (3) Mr. REESE.

215. **Dynamics.** Introduction to the fundamental principles of mathematical physics. (3) Mr. REESE.

209. **Electron Theory.** Lectures and assigned readings. (3)

210. **Seminary.** Critical reading and discussion of current research work in physics. A colloquium in which all members of the teaching staff of the department and students of sufficient attainments take part. (1)

211. **Research Work.** Hours to be arranged. Mr. STEWART; Mr. REESE; Mr. RENTSCHLER.

225a and 225b. **Recent Developments in Experimental Physics.** Lectures and demonstrations. (1) or (2) Mr. RENTSCHLER.

226. **Recent Developments in Theoretical Physics.** Lectures and assigned readings. (2) Mr. REESE.

GROUP OF BIOLOGICAL SCIENCES

ANATOMY

105a or 105b. **Topographic Anatomy.** A study of the topography of the various organs by means of serial sections through the body. Open only to students who have completed the undergraduate courses in anatomy. Laboratory. (2) Mr. CLARK; Mr. JOHNSON.

206a and 207b. **Advanced Anatomy.** Elective. Prerequisite: course 102a, 103b, or 104b. Advanced work will be given in any of the special fields of anatomy, the amount and character of which will be varied to suit individual needs. Mr. CLARK; Mr. JOHNSON.

208a and 209b. **Research.** Problems of original investigation will be assigned in anatomy, histology, or embryology. A reading knowledge of French and German is required. Hours to be arranged. Mr. CLARK; Mr. JOHNSON.

BOTANY

100a. **Plant Physiology.** Lectures and laboratory work on the physiology of the common cultivated plants, covering such topics as absorption, transpiration, synthesis of carbohydrates and proteins, digestion, translocation, respiration, growth, reproduction, and the reaction of plants to stimuli. (5) Mr. REED; Miss KEENE.

101b. **Taxonomy and Ecology of Seed Plants.** Prerequisite: course 100a. The morphology, life histories, and classification of the seed plants of the local flora; relation of plants to their environment, including a discussion of the origin, development, structure, and succession of plant formations. (5) Mr. MANEVAL.

102a. **Plant Pathology.** Prerequisite: course 3a or b. Life histories of important parasitic fungi and their pathological effects upon the host; isolation of parasites, technique of culture methods, and inoculation of the host. (3) Mr. REED.

104a. **Histological Methods.** Methods used in the preparation and preservation of class material and in fixing, sectioning, and staining of sections for microscopical study. (2) Mr. DURAND.

105. **Comparative Morphology and Embryology.** Should be preceded or accompanied by courses 12b and 13b. Structure and life history of selected representatives of the great groups of green plants. Special attention will be given to tracing the development and homologies of sterile, sporogenous, and reproductive parts such as the formation of spores and gametes, fertilization, the development of the embryo. (3) Mr. DURAND.

106b. **Plant Breeding and Cytology.** The study of the cell as the unit of structure and function, and as the physical basis of heredity. Particular emphasis upon the fundamental principles of plant breed-

ing including hybridization, Mendelian phenomena, etc. (3 or 5) Mr. REED.

107b. **Problems in Plant Physiology.** Prerequisite: course 100a. Lectures and discussions on physiological problems. The work in any given semester is confined to some special topic as mineral nutrients, photosynthesis, respiration, etc. Laboratory work on the subject considered may be elected for additional credit. (2-5) Mr. REED; Miss KEENE.

108b. **Diseases of Forest Trees.** Prerequisite: course 102a. Required of students in forestry. Takes up a study of the fungous diseases of forest trees, the fungi which cause decay in timber, and the methods of timber treatment. (3) Miss KEENE.

109b. **Diseases of Horticultural Plants.** Prerequisite: course 102a. The life histories, pathological effects, and control of the fungi causing disease in vegetables and orchard trees. (2) Mr. REED.

110a. **Principles and Methods of Disease Control.** Must be preceded or accompanied by course 102a. A study of fungicides in their relation to host and parasite, their composition, preparation, and methods of application; other methods of disease control, including the development of disease-resistant plants. (2) Mr. REED.

200. **Seminary.** Special subjects of botanical work will be taken up and discussed, including the results of investigations carried out in the department. A reading knowledge of French and German is essential. (1) Mr. REED.

201. **Research.** Students who have had adequate preparation will be assigned some special problem for investigation. A reading knowledge of French and German is essential. Credit and hours to be arranged. Mr. REED; Mr. DURAND; Mr. MANEVAL.

PATHOLOGY

201a or 201b. **Advanced Pathology.** The amount and character of the work will depend upon the needs and qualifications of the student. In connection, opportunity will be afforded for practical experience in the handling of all kinds of morbid material. Hours to be arranged. Mr. DOLLEY; Mr. MUNS.

202. **Research.** Opportunity is offered to students sufficiently prepared for original investigation of unsolved problems in the fields of pathology and pathological physiology. A reading knowledge of German is required and French is recommended. A seminary is held once a week. Mr. DOLLEY.

203. **Normal and Abnormal Neurocytology.** The application of the general principles and theories of biology to the nerve cell in health and disease. The work will necessarily consist largely of original investigation and will be adjusted to the training of the student. Hours to be arranged. Mr. DOLLEY.

204a. **Pathological Physiology.** An experimental course. (2) Mr. DOLLEY; Mr. MUNS.

PHYSIOLOGY

101a. **General Physiological Chemistry.** Prerequisite: Chemistry, course 111. Physiological chemistry of the carbohydrates, fats, and proteins; of the cell and special tissues; of the blood; of respiration; of metabolism; of secretions and excretions; and a quantitative study of the urine in relation to diet. (4) Mr. GULICK; Mr. BASKETT.

102a. **Physiology of Secretion, Metabolism, and Reproduction.** The physiology of secretory processes, digestive mechanics, absorption, excretion, respiration, metabolism and energy exchange, heat regulation, and reproduction. (2) Mr. KRUSE; Mr. PREWITT.

103a. **Experimental Physiology.** The physiology of circulation, respiration, muscle and nerve, nervous system, and sense organs. (6) Mr. GREENE; Mr. KRUSE; Mr. PREWITT.

104a and 104b. **Advanced Physiological Chemistry.** A course supplementing and extending course 101a. The preparation and chemistry of the proteins; a qualitative and quantitative study of the tissues and secretions, of enzymes, of putrefaction and putrefactive products; analyses of typical foods; and the detection of food preservatives and adulterants. The prosecution of a short investigation and formal report on the same are required. (2-4) Mr. GULICK.

105b. **Pharmacology.** Presents the physiological action of drugs from the experimental point of view. The demonstrations are made on man and the lower animals. (4) Mr. GREENE; Mr. KRUSE.

107b. **Toxicology.** Prerequisite: course 104a or 105b. (2 to 3) Mr. GULICK.

109b. **Physiology of Development and Growth.** Prerequisite: elementary physiology, 1a or 1b, or equivalent. A course of lectures and assigned reading, with special emphasis on factors that influence the capacities of the developing nervous system. (2) Mr. GREENE.

206a. **The Physiology of the Nervous System.** (3) Mr. GREENE.

208. **Journal Club.** (1) Mr. GREENE.

209a. **The Physiology and Pharmacology of the Circulatory System.** (3) Mr. GREENE.

210a and 210b. **Advanced Physiology.** Advanced courses in physiology, physiological chemistry, and pharmacology. Individual problems will be assigned to students of sufficient preparation. Hours to be arranged. Mr. GREENE; Mr. GULICK.

211. **Investigation.** Opportunity is offered for research into questions of current physiological interest. Mr. GREENE; Mr. GULICK.

PREVENTIVE MEDICINE AND BACTERIOLOGY

102a. **Pathological Bacteriology.** Prerequisite: Botany, course 3a or 3b. Subjects studied include: relation of bacteria to disease; the fundamental principles of immunity, serum diagnosis, serum and vac-

cine therapy. The different diseases are discussed, and the micro-organisms causing them are studied in the laboratory, with animal inoculations and demonstrations. The course includes also the study of the best known diseases caused by protozoa. (4) Mr. RAVENEL; Mr. DUPRAY; Mr. SPENCE.

201a and b. **Advanced Bacteriology.** Prerequisite: course 102a. Amount and character of work will depend on needs and qualifications of student. The manufacture of autogenous vaccines, the determination of the opsonic index, making and use of various sera, and the study of milk and water are among the subjects suggested. Hours to be arranged. Mr. RAVENEL; Mr. DUPRAY; Mr. SPENCE.

202. **Research.** Prerequisite: course 102a. Students who are sufficiently prepared will be given problems requiring original investigation in the fields of bacteriology and public health. A reading knowledge of French and German recommended. Hours to be arranged. Mr. RAVENEL; Mr. DUPRAY.

203. **Conduct of Public Health Laboratories.** Prerequisite: courses 102a and 201a. Designed for those who expect to take up such work as a profession or for teaching purposes. Graduates in medicine preferred. The collection and shipment of various specimens, their examination, milk and water problems, etc. will be discussed and the practical work carried out in the laboratory. Hours to be arranged. Mr. RAVENEL; Mr. DUPRAY; Mr. SPENCE.

ZOOLOGY

100a. **Zoology of Invertebrates.** A comparative study of invertebrates. May be taken advantageously by students who expect to teach zoology. (5) Mr. CURTIS.

101a. **Embryology of Vertebrates.** Designed to lay the foundation of vertebrate embryology. Successive stages in the development of the frog, the chick, the pig are studied from preparations of entire embryos and from serial sections. These observations are used as a basis of comparison for the study of human embryology. (3) Mr. LEFEVRE; Mr. TANNREUTHER.

102b. **Comparative Embryology of Invertebrates.** A comparative study of the development of representative forms from the principal phyla of the invertebrates, including a consideration of general phylogenetic and morphological problems. (3) Mr. CURTIS.

103b. **Cytology.** A study of the cell, with special reference to problems of development and inheritance. Cytological technique. (5) Mr. LEFEVRE.

104a. **Genetics and Evolution.** A course of lectures dealing with the experimental study of genetics and its relation to the problems of organic evolution. Emphasis is laid on the phenomena of Mendelian inheritance and the cellular mechanism of heredity. (2) Mr. LEFEVRE.

105a. **Animal Ecology.** Prerequisite: course 100a. Physiology, habits, life-histories, and distribution of animals in relation to environmental conditions. Recommended to students who expect to teach zoology. (3) Mr. DODDS.

106b. **Parasitology.** A study of the fundamental principles of parasitology; life-histories, behavior and reactions of animal parasites, and the effects produced upon their hosts. (3) Mr. GLASCOCK.

107a and 108b. **Special Problems.** Preparation for research in zoology. Hours to be arranged. (3) Mr. LEFEVRE; Mr. CURTIS; Mr. DODDS.

200. **Research.** A reading knowledge of French and German is essential. Investigation of unsolved problems of zoology, in which the student is trained in the exercise of original observation and thought. Hours to be arranged in accordance with the requirements of individual students.

201. **Seminary.** A reading knowledge of French and German is essential. Meetings at which subjects of zoological investigation are discussed by instructors and students. Each student is required to give at least four lectures during the year, and experience is thus gained in presenting in the form of lectures the results of reading and research. (1)

HISTORY OF ART

111. **History of Renaissance Painting.** Should be preceded or accompanied by European History (History, course 1a). With Italian Painting, European Culture and Civilization (History, course 150a) is also earnestly recommended. First semester: Italian Painting. Second semester: Painting of the Netherlands and of Germany. (3) Mr. PICKARD.

113. **Masterpieces of Architecture, Sculpture, and Painting of Classical, Renaissance, and Modern Times.** Lectures fully illustrated with the stereopticon. Aims to show the historical development of art by the discussion of some of the finest examples in each of the three divisions mentioned. (1) Mr. PICKARD.

216. **Seminary in the History of Art.** Hours and work to be assigned. Mr. PICKARD.

As supplementary to all courses offered in the history of painting and of sculpture, Introduction to Art (Theory and Practice of Art) is recommended.

For courses in Classical Archaeology and Art, see page 9.

THEORY AND PRACTICE OF ART

103. **Theory of Design.** Prerequisite: course 2a or 2b or its equivalent. The study of design as an art activity fundamental to the fine arts and crafts and a basis for art criticism. The problems of pure

design; the relation of the art product to its environment; the relation of the esthetic to other factors in the work of art; the application of the principles of design to definite problems. Two lectures and one laboratory period a week. (3) Mr. ANKENEY; Mr. CARR.

104. **Architecture.** Prerequisite: course 2a or 2b, while course 103 is advised in addition. A study of the essentials of architecture with stress laid on the meaning of architecture to society. Lectures and recitations and laboratory. Study of examples with original exercises in composition. (3) Mr. WELCH.

105. **Pictorial Composition.** Prerequisite: course 4 or courses 2a or 2b and 103. Exception may be made to students possessing technique of photography. Study and practice in the making of pictures. (2) Mr. CARR.

106. **Painting.** Prerequisite: course 4, while course 103 is advised in addition. Style, theory, and method as exemplified in some of the important schools and movements. Lectures, study of examples, and reading. Experimental practice in painting in several of the principal modes. (3) Mr. ANKENEY.

107. **Tone.** An advanced painting course. Two periods a week will be given to work directly under the instructor, in addition to which the student will be expected to paint a great deal alone, bringing in the work for criticism. (3-5) Mr. ANKENEY.

108. **Life.** An advanced drawing course. Drawing and modeling the figure from life. (3-5) Mr. ANKENEY.

202. **Problems of Design.** Prerequisite: course 103. Advanced problems in some field of design. (2-5) Mr. ANKENEY; Mr. CARR; Mr. WELCH.

204. **Problems of Form.** Prerequisite: course 108. An investigation of various theories of representation. (2) Mr. ANKENEY; Mr. CARR.

206. **Design in Relation to Drama.** Prerequisite: courses 103 and 105. Study of the pictorial problems of the stage. (2) Mr. CARR.

208. **Traditions of Painting.** Prerequisite: courses 103, 105, and 106. An investigation into the processes of the old masters with the adaptation of their traditions to modern work. (2-3) Mr. ANKENEY.

231. **Problems in the Teaching of Art in Secondary Schools and Colleges.** In this course every possible opportunity will be given the student to conduct original investigation in some phase of this field. (2-5) Mr. ANKENEY.

HOME ECONOMICS

101a. **House Sanitation.** Prerequisite: physiology, bacteriology, or preventive medicine. Situation, ventilation, heating, lighting, water supply, drainage, and care of the house in reference to health, con-

venience, and cost. Public sanitation as it relates to the household is considered. (3) Miss KNEELAND.

110b. **House Planning and Furnishing.** Prerequisite: course 101a and design. A study of the planning and furnishing of the house from the standpoint of convenience, economics, health, and art. The type of house is considered in relation to surroundings, materials used, size, cost, and adaptability to special needs of the family. House plans are studied and the equipment and decoration of each room is considered in detail, convenience and cost being especially emphasized. Each student plans and furnishes a house to suit certain definite conditions. (3) Miss RONZONE.

120. **Food and Nutrition.** Prerequisite: organic chemistry, physiology, bacteriology, or preventive medicine. Composition of foods and the principles underlying their preparation and preservation; application of the knowledge the students have gained of chemistry, physics, and bacteriology. The digestion, absorption, and comparative nutritive value of the different foodstuffs are considered with the idea of planning and preparing meals to meet the normal food requirements. (3) Miss KNEELAND.

121. **Metabolism and Dietetics.** Prerequisite: course 120 and its prerequisites. Behavior of foodstuffs in the body through a study of the metabolic products and their significance. These are first considered from the standpoint of the normal individual, and the dietaries planned in course 120 are interpreted in the light of this metabolic behavior. Abnormal metabolic conditions are considered from the standpoint of the light they throw on abnormal dietetics. Dietaries are planned to meet such abnormal conditions. (3) Miss STANLEY.

152. **Advanced Clothing.** Prerequisite: course 52 and design. A continuation of course 52 with special application of the principles of hygiene, economics, and art to the costume. (3) Miss RONZONE.

201. **Research.** Original investigation of problems in the field of home economics. Open to those with sufficient preparation. A reading knowledge of French and German is required. Miss STANLEY; Miss KNEELAND; Miss RONZONE.

AGRICULTURE

AGRICULTURAL CHEMISTRY

101a and b. **Advanced Agricultural Chemistry.** A continuation of the regular undergraduate course in agricultural chemistry, which is required of all undergraduate students in agriculture. A critical study of methods in use in the chemical laboratories of the experiment station will be made, including an examination of foods and feeding stuffs for adulteration, etc. Three to five periods per week, including one lecture

or recitation each week. Hours to be arranged. Mr. TROWBRIDGE; Mr. HAIGH; Mr. MOULTON.

201a and b. **Seminary.** (1) Mr. TROWBRIDGE.

202a and b. **Research.** May be elected either as major or minor and may include a thesis showing the results of the investigations. The chemical laboratories offer exceptional facilities for research. Subjects may be selected in (a) animal nutrition; (b) composition of animal fats as affected by feeding, age, breed, etc.; (c) the composition of meats, feeding stuffs, fertilizers, soils, etc.; (d) the chemical problems involved in the dairy industries; (e) the distribution of phosphorus in the animal organism with special reference to the separation of phosphorous compounds; (f) chemical problems involved in the enforcement of state and national pure food laws; (g) the separation of proteins of flesh and study of their hydrolytic cleavage products. (3-5) Mr. TROWBRIDGE; Mr. HAIGH; Mr. MOULTON; Mr. PALMER.

203a. **Chemistry of the Proteins.** A critical study of the composition and classification and of the decomposition products of the meat and vegetable proteins. Lectures and recitations. (3) Mr. TROWBRIDGE.

204a. **Physiological Chemistry of the Domestic Animal.** Designed to meet the requirements of students fitting themselves for investigations in animal nutrition. (3) Mr. PALMER.

ANIMAL HUSBANDRY

200. **Seminary.** Special investigation bearing on selected lines in animal husbandry. The preparation and presentation of papers for discussion by the class. (1) Mr. MUMFORD; Mr. TROWBRIDGE; Mr. ALLISON.

201. **Experimental Feeding.** Original investigations of important problems in feeding cattle, sheep, and swine. This course is intended to give experience in methods of experimental work and to make the student familiar with the most approved methods of investigation. (2) Mr. TROWBRIDGE; Mr. ALLISON.

202. **Research in Animal Husbandry.** Advanced studies of special phases of animal production. Recommended to students who desire more thorough training in the production of cattle, horses, sheep, or swine, or who may wish to make a more careful study of the fundamental principles of animal husbandry. Mr. MUMFORD; Mr. TROWBRIDGE; Mr. ALLISON.

203. **Animal Breeding.** Research in special subjects bearing on the inheritance and development of characters in the domestic animals. Mr. MUMFORD.

204. **Zoometry.** Special investigation of the relations of form and function in the domestic animals. Mr. TROWBRIDGE.

205. **Research in Stock Farm Management.** Investigations of the principles governing successful systems of stock farm management. Special studies of highly efficient stock farms. (2) Mr. MUMFORD; Mr. TROWBRIDGE; Mr. ALLISON.

DAIRY HUSBANDRY

100b. **Milk Production.** The breeds of dairy cattle; selection, breeding, and development of a dairy herd; care and management of dairy cattle; feeding for milk production; production of certified and market milk; milk for butter-making and cheese-making; utilization of by-products of the dairy. Mr. ECKLES.

201. **Seminary.** The object of this course is to train the student to do independent work and to develop the spirit of research. It consists of special investigation and study along selected lines of research with review and discussions of recent work. Each student presents papers on selected topics and reports on recent scientific investigations and on current literature of the subject. Mr. ECKLES.

202. **Research in Dairy Husbandry.** A large herd of highly developed dairy cattle representing four breeds makes it possible to offer facilities for study and investigation of a variety of subjects pertaining to milk production and the care and management of dairy cattle. Students interested in this line are allowed to carry out certain experiments with the dairy animals and in some cases to assist in lines of investigation under way in the Agricultural Experiment Station. Mr. ECKLES.

203. **Special Investigations in Dairy Chemistry.** The chemical composition of milk, butter, cheese, etc., and the factors influencing their composition offer many attractive problems for graduate research. Unusual facilities are offered graduate students of good training in organic or agricultural chemistry to carry on independent investigations along the lines mentioned. The results obtained are usually of such a character that they can be published in one of the chemical journals. Mr. PALMER.

204. **Dairy Bacteriology.** This will be laboratory investigation of certain problems of bacteriology in relation to dairying, the object being chiefly to give training in methods of research in this line. The work will be adapted largely to the individual student. Mr. ECKLES.

205. **Dairy Manufactures.** Opportunity and facilities are given to study and investigate problems in butter-making, cheese-making, and other lines of dairy manufactures. Mr. ECKLES; Mr. RINKLE.

ENTOMOLOGY

110b. **Advanced Economic Entomology.** Open only to students who have taken course 2a or 2b. Lectures, laboratory, and field work.

Two afternoon periods a week by appointment. (3) Mr. HASEMAN; Mr. HOLLINGER.

111a. **Morphology, Histology, and Development of Insects.** Open only to students who have taken courses 2a or 2b, 103a, and 104b, or the equivalent. Lectures and demonstrations. (3) Mr. HASEMAN.

200. **Research.** Open to students prepared to undertake independent investigation. Opportunity is offered for original investigation of economic, morphologic, and systematic problems presented by our local insect fauna. Mr. HASEMAN.

201. **Seminary.** Open to students especially interested in entomological work. Reviews of current literature and reports on original investigation are given by the students. (1) Mr. HASEMAN.

FARM CROPS

101a. **Cereal Crops.** Prerequisite: course 1a or b. An advanced course dealing with the history, characters, adaptation, culture, uses, and distribution of the principal cereal crops, based largely on a study of literature and experimental data. Laboratory study of the principal types and varieties. Two lectures and one laboratory period a week. (3) Mr. HUTCHISON; Mr. McDONALD.

102a. **Forage Crops.** Prerequisite: course 1a or b. An advanced course dealing with the history, characters, adaptation, culture, uses, and distribution of the principal forage plants. Laboratory study of the principal types and varieties. Based largely on a study of literature and experimental data. Two lectures and one laboratory period a week. (3) Mr. HUTCHISON; Mr. HACKLEMAN.

103b. **Fiber Crops.** Prerequisite: course 1a or b. An advanced course dealing with the history, distribution, culture, characters, harvesting, marketing, uses, and improvement of the principal fiber crops, with special reference to cotton. (2) Mr. EVANS.

104b. **Field Crop Improvement.** Prerequisite: courses 101a and 102a. A study of the laws of variation and heredity, the theory of mutation, the pure line theory, and Mendelism, as applied to the breeding of the principal farm crops. Laboratory studies in the inheritance of characters and the use of statistical methods in measuring variation, correlation, and heredity. (3) Mr. HUTCHISON.

105. **Special Problems.** By permission. Primarily for advanced undergraduates who show proper preparation. Topics will be assigned or may be chosen subject to approval. Hours by appointment. Mr. HUTCHISON; Mr. HACKLEMAN; Mr. McDONALD.

201. **Research.** By permission. Original research in problems pertaining to the production, management, and improvement of farm crops. Hours by appointment. Mr. HUTCHISON.

202. **Seminary.** By permission. Discussion of various phases of investigations pertaining to the production, management, and im-

provement of farm crops. Papers on assigned topics and reports on recent investigations and current literature on the subject are presented by the student. Required without credit of graduate students majoring in Farm Crops. (1) Mr. HUTCHISON.

FARM MANAGEMENT

112a. **Farm Records.** Prerequisite: course 105a. A detailed study of the results of record work—what the records reveal in the way of successful or unsuccessful management and methods. (2) Mr. GREEN.

113b. **Farm Administration.** The application of the principles gathered in course 110b; making detailed and balanced plans for special farms and considering the handling and management of crops and stock under those special conditions. (2) Mr. JOHNSON.

200. **Seminary.** Selected literature and special field investigations of farm management problems, to be used as the basis for original outlines, and detailed plans for improving systems of farming. Mr. JOHNSON; Mr. GREEN.

201. **Investigation of Types of Farming.** Field investigations of the different types of farming occurring in a given region, including careful and detailed study of farm practices and incomes. Thesis required. Mr. JOHNSON; Mr. GREEN.

202. **Investigation of Cost of Production and the Distribution of Labor.** Field investigations of the comparative cost of producing farm products and the distribution of labor on Missouri farms. Thesis required. Mr. JOHNSON; Mr. GREEN.

207. **Investigation of Systems of Farm or Rural Practices and Organizations.** Original research covering present farm practices and their practical application. Also a study of rural institutions or organizations that directly affect or are related to farm management. Thesis required. Mr. JOHNSON; Mr. GREEN.

HORTICULTURE

105a. **Advanced Pomology.** The study of the principal species, types, and varieties of cultivated fruits and their related forms, together with a consideration of their variation, modifications, and adaptations under culture. The living plant collection on the horticultural grounds and a large number of varieties, types, and grades of apples, together with other varieties of fruits both in a fresh and a preserved state, afford material for study of types and varieties for exhibition and marketing purposes. Hours by appointment. (3) Mr. LAWRENCE; Mr. WHITTEN; Mr. WIGGANS.

107. **Plant Materials.** Trees, shrubs, and vines. Practical course designed to familiarize the student with the character, habits, and

adaptation of ornamental trees, with special reference to their use in cities, parks, and private estates. This course is especially designed to train students for the positions of park superintendent, city forester or warden, nurseryman, or landscape plantsman and includes tree shaping and surgery, practicum and field work. Hours by appointment. (2) Mr. MAJOR.

108. **Elementary Design.** First semester: topographical and mechanical drawings and lettering. Second semester: tracings and original designs in home, school, church, cemetery, and railroad gardening. Hours by appointment. (3) Mr. MAJOR.

111. **Special Problems.** Primarily for advanced undergraduates. Topics will be assigned to students who show proper preparation. Hours by appointment. Mr. LAWRENCE; Mr. WHITTEN; Mr. MAJOR; Mr. WIGGANS; Mr. GARDNER.

200. **Special Investigation.** For graduates and advanced students. Special problems for investigation will be assigned. Hours by appointment. Mr. LAWRENCE; Mr. WHITTEN; Mr. MAJOR; Mr. WIGGANS; Mr. GARDNER.

SOILS

101a. **Soil Technology.** Prerequisite: course 1a. A course designed to give the student a knowledge of soil technology from the standpoint of laboratory and field studies in soil physics and soil fertility. Special experiments designed to demonstrate important soil processes and phenomena constitute the laboratory and field practice work. (5) Mr. MILLER; Mr. LE CLAIR.

102a. **Soil Surveying.** Prerequisite: course 1a. A course designed to familiarize the student with the methods and actual practice of detailed soil survey work. The work consists of the preparation of soil maps of areas near Columbia, the sampling of the soil types, the mechanical analysis of samples taken, and the preparation of a soil survey report on the area. Two practicums a week. (2) Mr. LE CLAIR; Mr. KRUSEKOPF.

103b. **Soil Investigations.** Prerequisite: course 1a or b and course 101a. A study of methods of soil investigation and the carrying out of investigations on assigned soil problems. Particular attention is given to methods and results of investigations in the United States and Europe. One lecture and two laboratory periods a week. (3) Mr. MILLER; Mr. HUDELSON.

104b. **Soils of the United States.** Prerequisite: course 1a. A course designed to familiarize the student with the general classes of soils throughout the United States, their characteristics, crop adaptations, and the systems of soil management adapted to each. (2) Mr. MILLER.

200. **Seminary.** Discussions of various phases of soil investigation. Papers on assigned topics are presented for discussion. A reading knowledge of French and German is recommended. (1) Mr. MILLER.

201. **Soil Research.** Original investigations in soils. The special work undertaken is determined by the preparation and needs of the student. (2-5) Mr. MILLER.

VETERINARY SCIENCE

201. **Topographic Veterinary Anatomy.** Prerequisite: course 1a. A study of the topographic anatomy of the horse, ox, and pig by means of serial cross-sections of preserved cadavers, supplemented by a study of anatomical surface points on the living subject.

This course is designed to meet the needs of advanced students who intend to specialize in animal husbandry along the lines of stock judging and meat production. (3) Mr. CONNAWAY.

202. **Contagious, Infectious, and Parasitic Diseases of Farm Animals.** In this course an effort is made to present as many clinical cases as possible, in order that the student may gain a practical knowledge of the clinical features as they are encountered in field experience. Experimental inoculations supplement the clinical study. Autopsies are made and the gross and microscopic lesions studied. The specific causes (bacteria and other micro-parasites and macro-parasites), where known, are isolated and studied. Such ground relating to this group of diseases as has been well covered in the minor course 3a is not repeated in this course. Text and reference books: Hutyra and Marek's *Veterinary Pathology*; Law's *Vet. Med.*, IV; Ostertag and Wilcox's *Meat Inspection*; Neumann's *Parasites and Parasitic Diseases*; Nocard and Leclainche's *Les Maladies Microbiennes des Animaux*; Kitt's *Bacterienkunde*; Herzog's *Disease Producing Microorganisms*. Special bulletins and veterinary journals. Lectures, assigned reading, clinics, and laboratory work. (3) Mr. CONNAWAY.

203. **Investigation.** Students who have suitable preparation will have an opportunity to assist in the Agricultural Experiment Station work. Studies on immunity in relation to hog cholera, infectious abortion in cattle, and roup in chickens will be continued during the coming session. (6) Mr. CONNAWAY.

ENGINEERING

CHEMICAL ENGINEERING

For the courses in chemical engineering see Chemistry, courses 126b, 127, 133, 142b, 211a, 212b, 221, 271.

CIVIL ENGINEERING

105b. **Geodetic Surveying.** Elements of geodesy, with practice in use of precise instruments and reduction of triangulation. (3) Mr. WILLIAMS.

114a. **Railway Maintenance.** Maintenance of track; signals; organization of engineering departments; accounting. (3) Mr. MILLER.

115b. **Railway Yards and Terminals.** Arrangement of terminal facilities for handling of both passenger and freight business; design, construction, and operation of yards of several kinds and types. (2) Mr. MILLER.

123b. **Higher Structures.** Swing bridges; arches; suspension and cantilever bridges; deflection of trusses. (3) Mr. HYDE.

126a. **Concrete Structures.** Theory of reinforced concrete structures with problems in design. (3) Mr. SPALDING.

143a. **Irrigation and Drainage.** Irrigation engineering, institutions, and practice; canals; ditches; reservoirs; land drainage. (2) Mr. RODHOUSE.

144b. **Rivers and Canals.** River improvements, training works, floods, levees, dredging, shore protection; waterways, canals and locks; river discharge. (2) Mr. RODHOUSE.

157b. **Sanitation and Sanitary Design.** General sanitation; garbage reduction; street cleaning; design of works for sewage disposal and water purification. (2) Mr. McCAUSTLAND.

201. **Geodesy and Precise Surveying.** Credit to be arranged. Mr. WILLIAMS.

211. **Railway Engineering.** Advanced course in construction, maintenance, and operation. Credit to be arranged. Mr. MILLER.

221. **Structural Engineering.** Special problems in advanced design. Credit to be arranged. Mr. HYDE.

222. **Concrete Structures.** Theory and design of concrete structures; special laboratory investigations. Credit to be arranged. Mr. SPALDING.

223. **Theory of Structures.** Statically indeterminate structures; secondary stresses. Credit to be arranged. Mr. HYDE.

231. **Experimental Investigation.** Hydraulic laboratory. Laboratory investigations concerning the properties and uses of the materials of construction. Credit to be arranged.

241. **Hydraulic Engineering.** Problems in hydraulics, irrigation, river and harbor improvements; hydraulic construction. Credit to be arranged. Mr. RODHOUSE.

251. **Sanitary Engineering.** Investigations and special problems in sanitary engineering. Credit to be arranged. Mr. McCAUSTLAND.

ELECTRICAL ENGINEERING

131b. Electric Motors. Prerequisite: course 103b or 110a. Construction, characteristics, and applications of electric motors to various classes of service. Comparison between electric and other methods of drive as to costs of installations, operating expenses, flexibility, convenience. (2) Mr. WEINBACH.

132a. Storage Battery Engineering. Prerequisite: course 111a. Theory, operating characteristics, and application of electric storage batteries; problems in the economic considerations of standby service, load equalization, and vehicle work. (2) Mr. WEINBACH.

133b. Illumination. Prerequisite: Physics, course 3. Characteristics of commercial types of electric lamps and their application to interior and exterior lighting. Problems in design of lighting systems from the standpoint of cost and satisfactory operation. (3) Mr. ATKINSON.

134a. Telephony. Design and operation of telephone systems. Electrical transmission and reproduction of speech. Propagation of high-frequency alternating currents in cables and overhead lines. Switchboard systems, manual and automatic. Types of line construction. Telephone traffic studies; facilities required. A few periods are devoted to laboratory work. Lectures and recitations. (2) Mr. ———

141b. Electric Railway Engineering. Prerequisite: course 130a. Electric railway systems; equipment and operation. Economic conditions governing the construction of an electric road. Methods of determining costs of equipment; determination of problem of gross earnings, fixed charges, operating expenses, maintenance. (2) Mr. WEINBACH.

142b. Transmission. Prerequisite: course 111a. Transmission of electric power. Economical aspects, practical limitations, operating precautions, and protective apparatus against disturbances originating in the various parts of the system. (2) Mr. LANIER.

143b. Electrical Processes. Miscellaneous practical applications of electricity in electro-chemical and metallurgical industries, including electroplating; electric welding; the theory, construction, and operation of electric furnaces. A few periods are devoted to laboratory work. (2) Mr. WEINBACH.

144. Central Station Management and Operation. Detailed study of problems of existing plants from the viewpoint of economical operation and satisfactory service. (2) Mr. WEINBACH.

180a or b. Applications of Mathematics to Electrical Engineering. Prerequisite: Mathematics, course 6. Stating the problem in mathematical form; approximate solutions; derivations of empirical formulæ, solutions of equations by graphical methods, application of complex numbers, exponential functions, and differential equations to electrical engineering problems. (2) Mr. LANIER; Mr. WEINBACH.

214a or b. **Transient Electrical Phenomena.** An advanced study of surges and oscillations which occur in high tension electrical apparatus. (2) Mr. ———

230a or b. **High Tension Laboratory.** (2) Mr. LANIER.

231a or b. **Special Electrical Laboratory.** (2) Mr. WEINBACH.

Courses 230 and 231 will be adapted to meet the attainments of individual students. Definite problems will be assigned which must be studied through existing literature and by experimental work.

240a or b. **Electrical Power Plant Equipment.** A continuation of course 140b, with special study of problems in switching, voltage control, metering, and arrangement of electrical apparatus. (2) Mr. WEINBACH.

270a or b. **Advanced Telephone Engineering.** Studies of special problems; laboratory work in transmission. (3) Mr. ———

290. **Research.** Original investigations along various lines in electrical engineering. Students taking research work will have as advisers those members of the staff most conversant with the problem undertaken.

MECHANICAL ENGINEERING

113a. **Hoisting and Conveying Machinery.** Not given in 1917-1918. The application of the principles of mechanics and machine-design in the construction of cranes, hoisting-engines, and conveyors for bulk material and for articles in industrial work. (2) Mr. WESTCOTT.

138a. **Boiler Design.** Not given in 1917-1918. Design, construction, and operation of steam-boilers. Studies of increased rates of heat transmission, and probable future boiler practice. Credit to be arranged. Mr. FESSENDEN.

201b. **Special Machine Design.** Not given in 1918-1919. Advanced work in kinematics, graphics, materials, and the design of apparatus and machinery for specific work. Credit to be arranged. Mr. HIBBARD; Mr. FESSENDEN.

211a. **Shopwork Engineering, B.** Not given in 1918-1919. Prerequisite: course 111 or course 112. Advanced analyses in production-engineering. Shop betterment. New mechanisms in efficiency management. Motion-studies. (2) Mr. HIBBARD.

212b. **Plants and Equipments.** Not given in 1917-1918. Layout and arrangement. Power, lighting, heating and ventilation for buildings, shops, plants, industrial institutions, and towns. Credit to be arranged. Mr. HIBBARD; Mr. FESSENDEN.

221a and b. **Special Mechanical Laboratory.** Advanced work in experimental engineering research. Tests of steam, gas, and water power-producing machinery, steam boilers and furnaces, bituminous coal gas-producer. Complete plant tests. Locomotive tests. Com-

bustion engineering. Tests on the experimental lathe and in commercial shops. Studies of the uses and development of indicating and recording apparatus as a means of obtaining and retaining increased operating efficiencies. Credit to be arranged. Offered by members of the staff in their respective lines.

231b. Thermodynamics, B. Prerequisite: course 139b. General thermodynamic methods; thermal magnitudes, relations, and analytical investigations; mathematical-physical and engineering applications. References to Zeuner, Planck, Preston, and other authorities. (2) Mr. WHARTON.

232b. Advanced Steam Turbine Design. Not given in 1917-1918. Prerequisite: advanced courses in steam-engineering or thermodynamics and machine-design. Problems in the design of nozzles, blades, discs and drums, shafts, governors. Credit to be arranged. Mr. FESSENDEN.

234. Gas Engineering. Not given in 1917-1918. Prerequisite: machine-design, either course 139b or course 132a and prime-movers. First semester on theory and practice of internal-combustion motors; fuel mixtures, flame propagation, ignition, valve action, and speed effects. Regulation, performance, installation, and operation; selective design. Second semester on the production, preparation, transmission, and use of industrial gases. (2) Mr. WHARTON.

251a. Refrigeration, B. Not given in 1918-1919. Prerequisite: a course in elementary thermodynamics, preceded or accompanied by steam machinery or prime-movers, and course 154a. Designs, plans, specifications, estimates for one or more selected studies as ice factory, cold-storage, district refrigeration, nursery, market, etc. Research, tests, improvements, appraisal, sales, management. Credit to be arranged. Mr. WHARTON.

261b. Railway Mechanical Engineering. Not given in 1918-1919. 1. Locomotive design, divided into boiler-plant, carriage, and steam-engine. Compounding, superheat, articulated. 2. Locomotive operation: service, maintenance, fuels, locomotive-terminals; testing; train-resistance. 3. Car design. 4. Railway shops: the layout, design, equipment, and operation of central shops for the general repair of locomotives and cars. Credit to be arranged. Mr. HIBBARD.

MECHANICS

112. Advanced Mechanics. Problems in dynamics. (3) Mr. DEFOE.

205. Elasticity. Mathematical theory of elasticity. (3) Mr. DEFOE.

209. Hydrodynamics. Mathematical theory of the motion of fluids. (2) Mr. DEFOE.

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- EDWARD MATHIEU, A. B., A. M.,
Instructor in Romance Languages.
- DANIEL CARROLL McEUEEN, A. B., A. M.,
Instructor in English.
- WALDEN EVERMONT MUNS, A. B., M. S., M. D.,
Instructor in Pathology.
- ALFRED HENRY NOLLE, A. B., B. S. in Ed., A. M., Ph. D.,
Instructor in Germanic Languages.
- ALMON ERNEST PARKINS, B. Pd., A. B., B. S., Ph. D.,
Instructor in Geology.

ETHEL RONZONE, B. S., A. M.,
Instructor in Home Economics.

HERBERT FOWLER SILL, M. S., Ph. D.,
Instructor in Chemistry.

ELBERT LAFAYETTE SPENCE, M. D.,
Instructor in Preventive Medicine.

GEORGE WASHINGTON TANNREUTHER, A. B., A. M., Ph. D.,
Instructor in Zoology.

AUSTIN HUBBARD WELCH, B. S. in M. E., M. E., B. Arch.,
Instructor in Architectural Drawing.

CLEO CLAUDE WIGGANS, B. S. in Agr., A. M.,
Instructor in Horticulture.

FELLOWS AND SCHOLARS, 1915-16

University Fellows:

LENA AMELIA BARBER, B. S., Adrian College, A. B., M. S.,
University of Michigan,
Botany.

EDITH LEOTA RUNDLE, A. B., B. S. in Ed., A. M., University of
Missouri,
Latin.

FERN HELEN RUSK, A. B., A. M., University of Missouri,
History of Art.

Gregory Fellow:

ALBERT GEYER LOOMIS, A. B., A. M., University of Missouri,
Chemistry.

Peabody Fellow in Education:

ABNER JONES, A. B., B. S. in Ed., University of Missouri.

University Scholars:

ERNEST FRANKLIN CANADAY, A. B., William Jewell College,
Mathematics.

LUCILE ARMER CARTER, A. B., Butler College,
Greek.

CHARLES DEGUIRE CHRISTOPH, A. B., University of Michigan,
English.

CLAUD FRANKLIN CLAYTON, A. B., University of Missouri,
Sociology.

ESTELLA FAYE CRATTY, B. S. in Ed., University of Missouri,
English.

HARRY LEE FOSTER, A. B., A. M., Central College,
Philosophy.

JULIA ELIZABETH GROVES, A. B., University of Colorado,
Romance Languages.

JEWELL CONSTANCE HUGHES, A. B., University of Arkansas,
Mathematics.

VERLE WEAVER MORRIS, B. S. in E. E., University of Missouri,
Physics.

CARL CLEVELAND TAYLOR, A. B., Drake University, A. M.,
University of Texas,
Sociology.

FRED ROY YODER, A. B., Lenoir College, A. M., University of
North Carolina,
Sociology.

Gregory Graduate Scholars:

THOMAS SWAIN BARCLAY, A. B., University of Missouri,
History.

DOROTHY KAUCHER, A. B., B. S. in Ed., University of Missouri,
English.

CHESTER RAY LONGWELL, A. B., University of Missouri,
Geology.

Agricultural Research Fellows:

DE HELLIK BRANSON, B. S. in Agr., Kansas Agricultural
College,
Animal Husbandry.

HARRY PROCTOR FISHBURN, A. M., University of Virginia,
Agricultural Chemistry.

CHARLES HERMAN WINKLER, A. M., University of Texas,
Horticulture.

**U. S. Department of Agriculture Research Fellow in the Improvement of
Cereal Crops:**

JOHN BARCLAY SMITH, B. S. in Agriculture, Purdue University.

Agricultural Research Scholars:

PAUL EDWARD CORRIVEAU, B. S., New Hampshire State Col-
lege,
Horticulture.

- ALBERT LARK DARNELL, B. S., Mississippi A. & M. College,
Dairy Husbandry.
- LEROY DEXTER JESSEMAN, B. S., New Hampshire State Col-
lege,
Horticulture.
- CHARLES ARTHUR JONES, B. S., University of Wyoming,
Animal Husbandry.
- JOSEPH MARSHALL MILLER, B. S. in Agr., University of Mis-
souri,
Farm Management.
- LEO LEAVITT RUMMEL, B. S. in Agr., University of Ohio,
Dairy Husbandry.
- WENZEL LOUIS STANGEL, B. S., Texas A. & M. College,
Animal Husbandry.
- DEE GRANVILLE SULLINS, B. S. in Agr., Alabama Polytechnic
Institute, B. S. in Agr., University of Missouri,
Animal Husbandry.
- RUSSELL M. VIFQUAIN, A. B., Nebraska Wesleyan University,
Soils.

Session of 1916-17, at Columbia

1916

June 8Thursday, registration
June 9Friday, organization of classes
August 4Friday, examinations

September 14, 15, and 16	Thursday, Friday, and Saturday, entrance examinations
September 18, 19, and 20	Monday, Tuesday, and Wednesday, registration
September 20	Wednesday, 11 a. m., opening convocation
September 21	Thursday, 8 a. m., class work in all divisions begins
November 1 to December 21 ...	First term, Two-Year Winter Course in Agriculture

November 29	Wednesday, 4 p. m.	} Thanksgiving holidays
	to	
December 4	Monday, 8 a. m.	} Christmas holidays
December 21	Thursday, 4 p. m.	
1917	to	} Midyear examinations
January 3	Wednesday, 8 a. m.	
January 8 to February 23	Second term, Two-Year Winter Course in Agriculture	
January 24	Wednesday	} Midyear examinations
to		
January 31	Wednesday	

February 1, 2	Thursday and Friday, registration, second semester	
February 3	Saturday, 11 a. m., opening convocation	
February 5	Monday, 8 a. m., class work in all di- visions begins	
February 22	Thursday, Washington's Birthday, hol- iday	
April 4	Wednesday, 4 p. m.	} Easter holidays
	to	
April 10	Tuesday, 8 a. m.	
May 27.....	Sunday, Baccalaureate address	
May 30.....	Wednesday, Commencement day	
May 31.....	Thursday,	} Final examinations
	to	
June 7	Thursday	

INFORMATION ABOUT THE UNIVERSITY GENERAL STATEMENT

The fundamental aim of the University of Missouri is the development of the highest and most efficient type of citizen. For the purpose of attaining its aim, the University furnishes ample facilities for liberal education and for thorough professional training. The University is a part of the public educational system of the state.

ORGANIZATION

The work of the University is now carried on in the following divisions:

- College of Arts and Science
- College of Agriculture
- School of Education
- School of Law
- School of Medicine
- School of Engineering
- School of Mines and Metallurgy
- School of Journalism
- School of Commerce
- Graduate School
- Extension Division

All of these divisions are at Columbia, with the exception of the School of Mines and Metallurgy, which is located at Rolla. In addition, emphasis is given particular lines of work by the establishment of minor divisions, the chief of which are the Agricultural Experiment Station, the Engineering Experiment Station, and the Missouri State Military School.

LOCATION

The University of Missouri is located at Columbia, situated half way between St. Louis and Kansas City, near the center of the state. It is reached by the Wabash and by the Missouri, Kansas and Texas railways. Columbia is a progressive and prosperous town having doubled its population in the last few years.

Columbia may be characterized as a town of schools, homes, and churches, with enough of industrialism to make it efficient. It offers

the conveniences of a larger city without the counter attractions. The student is a predominant factor in Columbia.

EQUIPMENT

The University grounds cover more than 800 acres. The main divisions are in the west campus, the east campus, the athletic fields, and the University farm.

The following University buildings are located at Columbia: Academic Hall; Laws Observatory; separate buildings for chemistry, physics, biology, geology, engineering, manual arts, law, commerce; two power houses; Medical Laboratory Building; Parker Memorial Hospital; Agricultural Building; Horticultural Building; Schweitzer Hall for agricultural chemistry; green houses; Live Stock Judging, Poultry, Dairy, Farm Machinery, and Veterinary Buildings; the agricultural college farm barns and buildings; Switzler Hall for the School of Journalism; Gordon Hotel Building for home economics; Benton and Lathrop Halls, dormitories for men; Read Hall and Sampson Hall, dormitories for women; Rothwell Gymnasium; the houses for the President of the University and the Dean of the College of Agriculture; the High School and the Elementary School buildings, used for practice schools in the School of Education. The new library building, containing the General Library and the State Historical Library, affords also commodious seminary rooms for the use of students in the graduate courses.

FOR FURTHER INFORMATION

For further information in regard to the Graduate School of the University, address

DEAN OF THE GRADUATE FACULTY,
UNIVERSITY OF MISSOURI,
COLUMBIA, MISSOURI.

Full information regarding the University is given in the catalogue, which will be sent on request without charge. For this or special bulletins of the College of Arts and Science, College of Agriculture, School of Education, School of Law, School of Medicine, School of Engineering, School of Journalism, School of Commerce, Extension Division, and the Graduate School, write to

DEAN OF THE UNIVERSITY FACULTY,
UNIVERSITY OF MISSOURI,
COLUMBIA, MISSOURI.

THE
UNIVERSITY OF MISSOURI
BULLETIN

VOLUME 17

Issued Three Times Monthly

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EDITED BY
H. H. KINYON
University Publisher

The General Series of The University of Missouri Bulletin consists of the announcements of the various colleges and schools which make up the University. These announcements will be sent free upon request to the Dean of the University Faculty, Columbia, Missouri.

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THE UNIVERSITY OF MISSOURI BULLETIN

VOLUME 18 NUMBER 1

GENERAL SERIES
1917, No. 1

ANNOUNCEMENT
OF THE
GRADUATE SCHOOL
1917-1918



UNIVERSITY OF MISSOURI
COLUMBIA, MISSOURI
January, 1917

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January, 1917

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Announcement of the Graduate School

GENERAL STATEMENT

Admission: Graduates of the colleges and universities comprising the Missouri College Union and of other reputable colleges and universities are admitted to the Graduate School. Admission to this school, however, shall not be understood as implying admission to candidacy for advanced degrees, which is subject to the regulations indicated below. Students are admitted to the Graduate School by the Registrar of the University to whom applications for admission should be addressed.

Fees and Expenses: Students are required to pay a library, hospital, and incidental fee of \$12 a semester. Those who file their study cards after the close of the last day of registration will be required to pay an additional fee of \$5 for late registration. Students taking laboratory work must make small laboratory deposits. The estimated cost of room rent and board for students living in Lathrop Hall or Benton Hall, the dormitories for men, varies, according to the room, from \$3.50 to \$4.50 a week. In Read Hall, the dormitory for women, it varies, according to the room, from \$5.75 to \$6.25 a week. The total necessary expenses of a student living in the dormitories for men need not exceed \$250 a year; in the dormitories for women they need not exceed \$350. The necessary expenses for students living in private families vary from \$4 to \$6 a week.

University Fellowships and Scholarships: The University offers annually a limited number of University Fellowships yielding each a stipend of \$400 a year. These fellowships will be awarded, according as the applicants, irrespective of department, have demonstrated their ability to render service in the form of research. The University offers also a limited number of scholarships bearing stipends of \$200 annually, open to graduate students of high promise in scholarship, irrespective of the lines of work they may desire to pursue. It is expected that scholars will be well qualified to do graduate work in the subjects which they elect and that they will devote themselves mainly to work in these subjects. They will be called upon to render a limited amount of service to the University. University fellows and scholars are allowed to engage in outside work only with the consent of the Dean of the Graduate Faculty and the professor of the subject which they elect. The Executive Board, upon the recommendation of

the dean and professor, may deprive any student of his fellowship or scholarship, whenever it may appear that he is not devoting himself as he should to his work as fellow or scholar. Applications must be filed not later than March 1, in order to receive consideration in the award for the following academic year. Applications received after this date and not later than June 1 will be considered in filling any vacancies that may occur in the fellowships or scholarships. Application blanks may be obtained from the Registrar of the University and when filled out should be sent to the Dean of the Graduate Faculty, Columbia, Missouri.

Gregory Fellowships and Scholarships: By the terms of the will of the late Charles R. Gregory of St. Louis, Missouri, the residue of his estate, amounting to approximately \$225,000, after providing for numerous bequests to charitable institutions, was left to the University of Missouri at Columbia to establish "The William Alexander Gregory Educational Fund." This must be invested by the Board of Curators "in a safe and prudent manner, the income from which shall be used in assisting white students of either sex in obtaining an education in any of the courses in said institution."

The Board of Curators has seen fit to provide that not more than \$1500 annually from this income may be used for the establishment and maintenance of fellowships and scholarships in the Graduate School to be known as the "Gregory Fellowships and Scholarships." These are awarded on the same conditions as the University fellowships and scholarships.

Peabody Fellowship in Education: In June, 1912, the trustees of the Peabody Education Fund gave the University the sum of \$6,000 on condition that it be held and used as an endowment of a Peabody Graduate Fellowship in education. The annual income from this fund will be paid to the holder of the fellowship.

Curators' Scholarships: By order of the Board of Curators, the student who attains the highest grade, or who shall be first in merit, in taking a bachelor's degree, in the graduating class of any of the colleges or universities composing the Missouri College Union will be admitted to this University for the first year without the payment of tuition, library, hospital, and incidental fees.

Agricultural Research Fellowships and Scholarships: The University offers annually a limited number of research fellowships in the Agricultural Experiment Station, each of the value of \$400, and scholarships, each of the value of \$200. It is the purpose of these fellowships and scholarships to foster and encourage original investigation and to give opportunity to students who desire to become efficient investigators in the field of agricultural science. All candidates for these fellowships and scholarships must fulfil the requirements for admission to the Graduate School of this University. (See page 3.)

These fellowships and scholarships are available in the departments of agricultural chemistry, animal husbandry, dairy husbandry,

horticulture, botany, entomology, farm crops, and soils. They will be awarded to the candidates who are best prepared and are of the highest promise in scholarship. Application blanks for these fellowships may be obtained from the Director of the Agricultural Experiment Station, Columbia, Missouri. Applications must be filed not later than March 1, in order to receive consideration in the award for the next academic year. Applications received after this date will be considered in filling any vacancies that may occur in these fellowships or scholarships.

United States Department of Agriculture Research Fellowship in the Improvement of Cereal Crops: The Bureau of Plant Industry of the United States Department of Agriculture has recently provided for a fellowship in cereal crops in the University of Missouri, bearing an annual stipend of \$400. This is the only fellowship of the kind offered in the United States. It is to be awarded to a graduate student in the University who has received special training for such investigations.

The purpose of these investigations shall be (a) to improve the cereal crops of the Central Mississippi Valley region as regards yield, quality, disease resistance, earliness, stiffness of straw, winter-hardiness, etc.; (b) to determine the best methods of cereal production; and (c) to study the fundamental laws of breeding and inheritance in cereals.

Literary and Scientific Societies: A number of literary and scientific societies are maintained in the University.

The following, conducted by members of the faculties, are open to advanced students: "The Scientific Association," organized with a "General Section" and special sections of "Biological Science," "Mathematical and Physical Science," and "Social and Political Science;" "The Classical Club," "Mathematical Journal Club," and "The University of Missouri Section of the American Chemical Society."

The following, among others, are conducted by students, in some cases with the participation of members of the faculties: "Medical Society," "Engineering Society," "Der Deutsche Klub," "French Club," "Sketch Club," "Asterisk Club," "History Club," "Branch of the American Institute of Electrical Engineers," "Branch of the American Society of Mechanical Engineers," "Physics Club," and "Forestry Club."

Publications: The "University of Missouri Studies," several series in "The University of Missouri Bulletin," and the "Publications of the Agricultural Experiment Station" are maintained as a means of publishing the results of original research in the University by instructors and graduate students.

University Libraries, Laboratories, and Museums: **LIBRARIES.** The University libraries comprise the general library and many departmental libraries. They contain about 175,000 volumes and pamphlets. Students have access also to the library of the State Historical Society of some 56,000 volumes and pamphlets.

LABORATORIES. Facilities for research in the sciences are provided in the following laboratories: animal husbandry, anatomy, astronomy, bacteriology, botany, chemistry, agricultural chemistry, dairy husbandry, engineering (civil, electrical, sanitary, and mechanical), entomology, experimental psychology, educational psychology, farm crops, geology and mineralogy, home economics, horticulture, pathology, pharmacology, physics, physiology, physiological chemistry, soils, veterinary science, and zoology.

MUSEUMS. There are also museums of art, classical archæology, ethnology, geology, and other collections.

Regulations Governing the Degree of Master of Arts: The degree of Master of Arts is offered to students who have spent at least one year exclusively devoted to advanced courses of study, and who have submitted an acceptable dissertation and passed all prescribed examinations.

A student wishing to make application for this degree must fill out a blank form, provided for the purpose, and must present it to the Dean of the Graduate Faculty on or before October 15.

In order to be accepted as a candidate for the degree, the student must give evidence that he has completed an undergraduate course of study such as is offered by colleges of good standing and that he has received a baccalaureate degree equivalent to the baccalaureate degree of the University of Missouri.

In making application the student must indicate the subject of the dissertation and the course of study selected by him on the form referred to above, which must bear the signature of approval of the professor in charge of his major subject, before it is presented to the dean for final action. He may, however, defer submitting the subject of the dissertation to the dean until November 1.

The candidate must choose a major subject, to which he must devote the greater part of his time during the year, and also such other subjects as may be approved. A majority of all work represented in the course of study must be selected from the courses strictly graduate in character.

A dissertation evincing capacity for original research and independent thought in the subject of the major work must be submitted to the Graduate Faculty for approval on or before May 15. The student should consult the Dean of the Graduate Faculty for information regarding the form in which the dissertation must be presented.

Each candidate for the degree of Master of Arts shall be required to pass final examinations, but the Graduate Faculty, upon the recommendation of the faculty of the department in which the candidate is taking his major work, may excuse the candidate from the requirement of a dissertation.

The attention of students is called to the fact that graduate work cannot be subjected to rigid regulation, and the Graduate Faculty reserves the right to deal with each case on its individual merits.

With the approval of the professors concerned, such candidates as have fulfilled all requirements may, at the close of the year, be recommended by the Graduate Faculty for the degree of Master of Arts.

Regulations Governing the Degree of Doctor of Philosophy: 1. **GENERAL STATEMENT.** The degree of Doctor of Philosophy is offered to students who have pursued advanced courses of study, without serious interruption, for a period of at least three years, and who have submitted an acceptable dissertation and passed all prescribed examinations.

In order to be accepted by the Graduate Faculty as a candidate for the degree of Doctor of Philosophy, the student must give evidence that he has completed an undergraduate course of study such as is offered by colleges of good standing and that he has received a baccalaureate degree equivalent to the baccalaureate degree of the University of Missouri.

The faculty reserves the right to decide in each case whether the antecedent training has been satisfactory, and, if any of the years of advanced work have been passed away from this University, whether they may be properly regarded as spent in university studies under suitable guidance and favorable conditions. Private study or study pursued at a distance from libraries and laboratories will not be considered as equivalent to university work. In any case, the student must spend the year immediately preceding his final examinations in residence at the University of Missouri.

It should be emphasized that the requirements for this degree are not computed in terms of time and courses, but that the degree is conferred only upon such students as have reached, after long study, a high attainment in some special branch of learning and have given the clearest evidence of their ability to carry on independent, original research by reason of having made an actual contribution to knowledge of a character approved by competent judges.

2. **ACCEPTANCE OF CANDIDATES.** A student wishing to make application for the degree of Doctor of Philosophy must fill out a blank form, provided for the purpose, secure thereto the signature of the instructor with whom he desires to take his major subject and present it to the Dean of the Graduate Faculty for approval on or before October 15. He must also give satisfactory evidence of ability to translate French and German readily at sight.

3. **REQUIREMENTS FOR THE DEGREE.** (a) **Subjects of Study.**—Every candidate for the degree must select one principal or major subject and at least one and not more than two subordinate or minor subjects, the combination to be approved by the Graduate Faculty. The instructor with whom the student is taking his major subject acts as his official adviser and has the general direction of his work.

The student's principal work must be in the major subject. Although no regulations are laid down with respect to the time to be devoted to the major and minor subjects, in general it may be stated that

the major subject should represent two-thirds of the student's entire time.

(b) *Dissertation.*—The dissertation, embodying the results of original investigation, must be written upon a subject approved by the adviser and must be submitted in typewritten form on or before May 15, when it becomes the property of the University. The student should consult the Dean of the Graduate Faculty for information regarding the form in which the dissertation must be presented.

Upon receiving the dissertation a committee is appointed whose duty it is to report upon it in writing to the Graduate Faculty.

The candidate is required to print or publish the dissertation, with such revision as the faculty may allow, and he shall present 150 copies of the work to the library of the University. The faculty shall take any necessary action to insure the publication of the dissertation within one year after the conferring of the degree. A brief biographical sketch of the writer must be appended to the dissertation.

(c) *Examinations.*—A committee, consisting of the professor of the candidate's major subject and the professors of his minor subjects, is appointed to take charge of all examinations and to report upon the same to the Graduate Faculty in writing.

In addition to final written examinations the candidate may be required to take an oral examination in the presence of the faculty.

(d) *Conferring of Degree.*—Upon the satisfactory completion of all requirements, the candidate may be recommended by the Graduate Faculty for the degree of Doctor of Philosophy.

COURSES OF INSTRUCTION

Courses preceded by a number with the letter a attached, thus: 104a, 106a, are given the first semester only. Those preceded by a number with the letter b attached, thus: 104b, 106b, are given the second semester only. Those preceded merely by a number are continuous courses and are given both semesters. The number of hours' credit given for a course for each semester is indicated by the Arabic numerals following the statement of the course. Courses numbered 200 and above are strictly graduate in character.

GROUP OF CLASSICAL LANGUAGES

CLASSICAL ARCHAEOLOGY

106. *History of Greek Art.* A preliminary study of Assyrian and Egyptian art, followed by a study of the development of Greek architecture and sculpture. Lectures, collateral reading, essays, with constant use of the lantern, photographic reproductions, and models and casts in the Museum of Classical Archaeology. Ancient history is recommended to the students of this course. (3) Mr. PICKARD.

107a. *Mycenaean Art or Art of Primitive Greece.* The earliest discoveries at Mycenae, Tiryns, and elsewhere will not be neglected,

but special attention will be given to the most recent publications on Troy, Crete, and the Argive Heraeum. (1) Mr. PICKARD.

108b. **Introductory Study of Greek Vases and Vase Paintings.** (1) Mr. PICKARD.

While a knowledge of the Greek language is not an absolute prerequisite for courses 107a and 108b, they are intended for advanced students in Greek.

109. **Etruscan and Graeco-Roman Art.** Should be preceded by course 106. It will deal with the earliest art of the Italian Peninsula, endeavor to show how this art reached its highest development among the Etruscans, how Etruscan influenced early Roman art, how later Roman art grew out of early Roman and late Greek art modified by the circumstances and character of the Romans. Ancient history is recommended to students in this course. (2) Mr. PICKARD.

110. **Roman Life.** A systematic study of the topography of Rome and of extant remains particularly of Rome and Pompeii. Lectures and readings. Illustrated by the use of plans, maps, and lantern slides. As supplementary to this course, Latin, course 103a and 104b, is recommended. (2) Mr. PICKARD.

214. **Topography and Monuments of Athens.** Frazer's Pausanias will be taken as the basis of discussion. A reading knowledge of Greek, French, and German is required. (2) Mr. PICKARD.

215. **Archaeological Seminary.** Hours and work to be arranged. Mr. PICKARD.

For courses in the history of art, see page 44.

GREEK

113a. **The Greek Theater.** The origin and development of the Greek theater will be considered and disputed points in the structure of the theater and in the presentation of plays will be discussed. The basis of the work will be Doerpfeld and Reisch's *Das Griechische Theater*. (1) Mr. MANLY.

114b. **Aristophanes.** Selected comedies will be read and the origin and development of comedy will be considered. Attention will also be given to the life of the people as revealed in the plays. (2) or (3) Mr. SCOGGIN.

216. **Hesiod and Homeric Hymns.** Students should provide themselves with *Hesiodi Carmina* ed. A. Rzach, Teubner, Leipzig, and *Hymni Homerici* ed. A. Baumeister, Teubner, Leipzig. (2) or (3) Mr. MANLY.

217. **Homer.** The whole of the Iliad and the Odyssey will be read during the year with especial attention to the antiquities. A special subject will be assigned each student for investigation. Teubner text editions of the poems should be secured in advance. (2) or (3) Mr. MANLY.

221. **Seminary.**

LATIN

101. **Latin Prose Composition.** Prerequisite, course 50. Advanced course. (1) Mr. COLBURN.

103a. **Cicero's Letters.** Not given in 1917-18. Prerequisites, courses 30 and 70. Study of Roman public and private life through the reading of the correspondence of Cicero. (3) Mr. COLBURN.

Students electing this course are advised to take with it course 106b in history.

104b. **Juvenal.** Not given in 1917-18. Prerequisites, courses 30 and 70. Study of Roman public and private life through the satires of Juvenal. (1) Mr. COLBURN.

106. **Catullus and the Elegiac Poets.** Not given in 1917-18. Prerequisites, courses 30 and 70. Selected poems of Catullus, Tibullus, Propertius, and Ovid. (3) Mr. MILLER.

109a. **Latin Comedy.** Prerequisites, courses 30 and 70. Representative plays of Plautus and Terence. (3) Miss JOHNSTON.

110a. **Quintilian X-XII.** Prerequisites, courses 30 and 70. (3) Mr. COLBURN.

111b. **Tacitus: Germania, Agricola, and Selections from the Annals.** Prerequisites, courses 30 and 70. (3) Mr. COLBURN.

115. **Rapid Reading.** Prerequisite, courses 103a and 104b, or equivalent. History of Latin literature, with readings from authors representative of each period. (2) Mr. MILLER; Mr. COLBURN.

125b. **Lucretius.** Prerequisites, courses 30 and 70. (3) Miss JOHNSTON.

217. **Seminary.** The historical development of Roman religion. Members of the class will present papers, based upon original sources, concerning primitive beliefs and rites, the adoption of various Italian festivals and deities, the invasion of Greek and oriental cults. (3) Mr. COLBURN.

SANSKRIT AND COMPARATIVE PHILOLOGY

218a. **Historical Greek Grammar.** Phonology and morphology. The lectures will deal systematically with noun and verb inflection within the Greek language itself. The student should procure Brugmann's *Griechische Grammatik* and Solmsen's *Inscriptiones Graecae ad illustrandas dialectos selectae*. (3) Mr. SCOGGIN.

219b. **Historical Latin Grammar.** The sounds and inflections of the Latin language will be set forth briefly in lectures. The student should own Lindsay's *Latin Language* and the same author's *Latin Inscriptions*. (3) Mr. SCOGGIN.

220. **Elementary Sanskrit.** Elements of the language. Translation of Sanskrit into English and English into Sanskrit. Thorough drill in forms. Whitney's *Sanskrit Grammar*; Lanman's *Sanskrit Reader*; and Perry's *Primer*. (3) Mr. SCOGGIN.

GROUP OF MODERN LANGUAGES

ENGLISH

101a and 102b. **Advanced Composition.** An informal course in practical composition open to a limited number of upperclassmen who can show that they possess some degree of literary talent. (3) Mr. MILLER.

106b. **Debating.** This course naturally follows 105a. Investigation of special questions; practice in debate. Designed especially for members of the debating squad. (3) Mr. McEUEEN.

109a and 110b. **Public Speaking (Advanced).** A study of the oratorical method of typical American and British orators; practice in writing and speaking. (2) Mr. TISDEL.

113a and b. **English Versification.** A study of the technique of English verse with weekly practice in metrical composition. (2) Mr. MILLER.

119. **The English Language.** A course in the science of language, with an examination, during the first semester, of the present facts of the English language, especially its vocabulary, dialects, and kindred tongues, its writing and spelling and its sounds; second semester, the past development of the language, especially in its inflections and syntax, with an introduction to Old English. (3) Mr. RAMSAY.

125a. **Chaucer and His Time.** A study of a considerable number of Chaucer's poems; reading of selections from other important authors of the fourteenth century; discussion of the chief types of Middle English literature. (3) Mr. RANKIN.

135a and 136b. **Shakespeare.** (a) Hamlet; (b) King Lear; Othello; Henry V; The Tempest. (3) Mr. FAIRCHILD.

156b. **The Queen Anne Period.** Not given in 1917-18. Mr. BELDEN.

161a. **The Novel.** The novel as a literary form; lectures and readings chosen to show the principal features of the nineteenth century novel. (3) Mr. BURROWES.

162b. **The Rise of English Prose Fiction.** Forms of narrative in English and the influences that aided in the development of the novel down to the opening of the nineteenth century. (3) Mr. BURROWES.

165a. **The Romantic Period.** A comprehensive lecture and reading course. (3) Mr. TISDEL.

166b. **The Victorian Period.** A comprehensive lecture and reading course. (3) Mr. TISDEL.

171a and 172b. **Modern Prose Writers.** A study of the works of representative authors, with weekly reports and monthly essays. (3) Mr. MILLER.

175. **American Literature.** (a) Sectional development; (b) growth of nationality; (c) present tendencies. The leading writers in prose and verse, considered first as to their intrinsic worth, and secondly as illustrative of national development. (3) Mr. BELDEN.

177a. **Recent and Current Literature.** Representative writers and literary movements of the last twenty-five years. (3) Mr. RAMSAY.

180b. **The Foreign Debt of English Literature.** The purpose of the course is to give the student some acquaintance with the greater literary master-pieces of the world and to indicate the nature and to some degree the extent of the influence which they have exerted upon English literature. (3) Mr. RANKIN.

210b. **Style and Usage.** An advanced course in the theory and practice of English composition, involving the investigation of important questions of usage, structure, and style. (3) Mr. MILLER.

219. **Literary Criticism.** The history of critical theory, with reading of standard works; examination of current theories and problems. (3) Mr. FAIRCHILD.

221. **Beowulf.** The study of the poem will be pursued as an exercise in Old English phonology, in text-criticism, and in the investigation of poetic principles. (3) Mr. BELDEN.

225b. **Middle English Literature.** Language and literature from the Norman conquest to Chaucer, with emphasis on the metrical romances. (3) Mr. RANKIN.

227b. **The Popular Ballad.** Not given in 1917-18. Mr. BELDEN.

233. **Historical Grammar.** A selected series of topics in the history of the origin and development of the English language. (3) Mr. RAMSAY.

235. **Elizabethan Drama.** History of the earlier Elizabethan drama; study of the works of Lyly, Kyd, Greene, Peele, and Marlowe; the doubtful plays of Shakespeare. (3) Mr. FAIRCHILD.

239b. **Later Elizabethan Drama.** The later contemporaries and successors of Shakespeare down to 1642. (3) Mr. RAMSAY.

245. **Milton.** Life, work, and times. (3) Mr. FAIRCHILD.

255. **Seminary.** Dryden and his contemporaries. Mr. BELDEN.

265. **Wordsworth and Coleridge.** The investigation of special topics, historical and critical. (3) Mr. TISDEL.

267. **Tennyson and Browning.** Not given in 1917-18. Mr. TISDEL.

GERMANIC LANGUAGES

104a and 104b. **Masterpieces in Modern German Drama, Lyrics, and Novel.** Intensive study, from the literary and cultural side, of a number of carefully chosen Modern German dramas, lyric poems, and novels. Parallel reading and reports. (3) Mr. ALMSTEDT.

105a. **Outline Course in German Literature.** The aim of the course is to acquaint the student with the most important works and movements in the evolution of German literary life. (3) Mr. HOFFMAN.

106b. **Lessing.** Lectures on Lessing's life and works; intensive study of Lessing, the dramatist and the critic; essays written in German; course conducted in German. (3) Miss STEWART.

107a and 108b. **Schiller.** Lectures on Schiller's life and works; intensive study of Schiller's dramas and poetry; essays written in German; course conducted in German. (3) Mr. HOFFMAN.

109a and 110b. **Goethe.** Lectures on Goethe's life and works; intensive study of Goethe's prose, poetry, and dramas; essays written in German; course conducted in German. (3) Mr. ALMSTEDT.

111b. **Outline Course in Historical Grammar.** This course together with course 105a is arranged to meet the needs of the prospective teacher of German. Though a knowledge of the older periods is desirable, it is not required. (3) Miss STEWART.

112b. **Advanced Composition and Conversation.** Advanced course in German theme-writing; discussions of grammatical, syntactical, and stylistic points. This course is intended for teachers of German or for students who propose to become teachers of German; conducted in German. (2) Mr. HOFFMAN.

113b. **Middle High German.** Introductory course. For advanced seniors. The class will study *Der Arme Heinrich* by Hartmann von Aue. Translation of medieval idiom into modern German. (3) Mr. ALMSTEDT.

114b. **German Drama of the Nineteenth Century.** An outline course in modern German political, social, and cultural movements, reflected in certain typical dramatists of this period. Lectures; parallel readings; reports. (3) Mr. NOLLE.

212. **German Literature of the Second Half of the 19th Century.** This course will consist of lectures and reports. During the first semester Hebbel, Ludwig, Freytag, and Wagner will be especially emphasized. The minor authors will be treated in lectures. The second semester will be devoted to a study of the realistic writers of Germany, especially Hauptmann, Sudermann, Wildenbruch, and Fulda. The foreign influence on these writers will be carefully considered. (3) Mr. HOFFMAN.

213b. **Romanticism.** This course is intended to comprise an exhaustive study, as far as is possible, of German romanticists and their works and to show the relation of this movement to similar ones in other literatures. (3) Mr. HOFFMAN.

214a. **The Reformation and Renaissance (1500-1750).** The aim of this course is to give the student a clear view of the development and decline of the literary tendencies, forms, and ideals of this period, and the influences that help to develop them or to accelerate their decline. (3) Mr. NOLLE.

215b. **Middle High German.** Walther von der Vogelweide. Discipline in phonology, morphology, syntax; comparison of medieval with modern idiom; a study in lyric poetry. (3) Mr. ALMSTEDT.

216b. **History of the Nibelungenlied.** This course comprises a study of the various theories as to the origin and authorship of the poem, the controversies in regard to it, and its relation to the Nibel-

ungensaga and other sagas. A reading knowledge of Middle High German is required. (3) Mr. HOFFMAN.

217b. **Old High German.** Prerequisite, course 220a. Phonology and forms; critical reading of Old High German texts. Texts: Braune, *Althochdeutsche Grammatik* and *Althochdeutsches Lesebuch*. (3) Mr. ALMSTEDT.

218a. **Old Norse.** Prerequisite, course 220a. Phonology and forms; critical reading of one or more sagas. Texts: Heusler, *Altisländisches Elementarbuch*; and Heusler, *Zwei Isländer-Geschichten*. (2) Mr. ALMSTEDT.

219b. **Old Saxon.** Phonology and forms; critical reading of the Heliand. A desirable antecedent, course 220a. (2) Mr. ALMSTEDT.

220a. **Gothic.** Phonology, morphology, and syntax; reading from Ulfilas; the relationship of Gothic to Indo-European and to later Germanic dialects; general introduction to the study of Germanic philology. (3) Mr. ALMSTEDT.

221. **Current Publications.** (1) Miss STEWART.

222. **Seminary.** Subject to be determined. For special students only. (2)

Other courses in Germanic languages will be arranged if the needs of the students require.

ROMANCE LANGUAGES

FRENCH

101. **French Phonetics.** The organs of speech, sound formation; drill in French pronunciation. (1) Mr. MURRAY.

105. **Practical Exercises in French.** Prerequisite, course 3. In exceptional cases, others may be admitted with the consent of the instructor. Designed to give students facility and accuracy in writing and speaking French; brief review of grammar and syntax; correction of pronunciation; translation into French; explanation of texts; practice in narration; discussions of current events based on some French periodical. Conducted entirely in French. (2) Mr. SELBERT.

107. **French Drama of the Seventeenth Century.** Prerequisite, course 3. In exceptional cases, others may be admitted with the consent of the instructor. The development of the drama in the seventeenth century will be studied with special reference to the work of Corneille, Racine, and Molière, whose most important plays will be carefully read. Lectures, assigned readings, reports. (2) Mr. HACKER.

110. **French Literature and Ideas in the Eighteenth Century.** Prerequisite, course 3. In exceptional cases, others may be admitted with the consent of the instructor. The intense intellectual activity of literary men of the eighteenth century; the influence of French literature on foreign literatures; Montesquieu, Voltaire, Rousseau, the Encyclopedists, etc. (3) Mr. CHERUBINI.

113a. **The Romantic Period.** Prerequisite, course 3. Others may be admitted with the consent of the instructor. The innovations of the Romantic writers; their insistence on liberty and individualism; the new impetus to lyric poetry; the only modern epic; drama and melodrama; historical and idealistic novel; creation of modern criticism. Reading of important works of Victor Hugo, Lamartine, Musset, Vigny, Gautier, Dumas, Sand, etc. Lectures, discussions, reports. (3) Mr. SELBERT.

114b. **Balzac and the Beginnings of Naturalism.** Prerequisite, course 3. Others may be admitted with the consent of the instructor. The transition from Romanticism to Naturalism; development of the psychological and realistic novel; the moral drama; tendency toward impersonal expression in lyric poetry; history as an art. Study of important works of Balzac, Stendhal, Mérimée, Flaubert, Dumas *filis*, Augier, Gautier, Banville, Baudelaire, Taine, Sainte-Beuve. Lectures, discussions, reports. (3) Mr. SELBERT.

115. **Recent and Current French Literature.** Prerequisite, course 3. In exceptional cases, others may be admitted with the consent of the instructor. Study of modern works from the point of view that some of them may become classics; sociological tendencies in the modern novel and drama; symbolists and decadents; the regionalistic movement in the novel; literary criticism as art or science; reading of significant works of Bazin Barrès, Bourget, Brieux, Brunetière, Anatole France, Loti, Maeterlinck, Lemaitre, Régnier, Richepin, Rostand, Verhaeren, etc. Lectures, conferences, reports. (3) Mr. MURRAY.

116. **The Literature of the Sixteenth Century.** Not given in 1917-18. Prerequisite, any of the following courses: 107, 110, 113a, 114b, 115. In exceptional cases, others may be admitted with the consent of the instructor. The first decisive steps in French literary art; Rabelais, as a sociological observer; Montaigne, the philosopher and stylist; Ronsard and the Pléiade, as the ancestors of the Romantic School of the nineteenth century; the beginnings of the drama. (2) Mr. WARSHAW.

208. **Early French Writers of Note.** The most prominent authors preceding the Renaissance; the development of the drama, mysteries and miracle plays, farces, sotties, and moralités; the historians; moral writers; the lyric poets. Reading of plays; Froissart, Joinville, Commynes, Christine de Pisan, Alain Chartier, Charles d'Orléans, François Villon, Gringore. (1) Mr. SELBERT.

212. **Seminary in French Literature.** Detailed study of some literary movement or representative writer. (2), (3), or (4) Mr. MURRAY.

214. **General Introduction to Romance Philology.** (2) Mr. MURRAY.

215. **Old French.** Prerequisite, course 214. (2) Mr. MURRAY.

216. **Seminary in Romance Philology.** Provençal, Old Spanish, Old Italian. (2) Mr. MURRAY; Mr. WARSHAW; Mr. CHERUBINI.

ITALIAN

121. **Italian Reading, Composition, and Conversation.** Prerequisite, course 20. Designed to train students to speak and write idiomatic Italian easily; review of grammar; important questions of syntax; translation of idiomatic exercises; reading of modern works. This course will be conducted entirely in Italian. (2) Mr. CHERUBINI.

123. **The Poets of the Rinascimento.** (2) Mr. CHERUBINI.

125. **Dante.** The *Divina Commedia*. Not given in 1917-18. (2) Mr. CHERUBINI.

SPANISH

134. **Latin-American Life and Literature.** Prerequisite, course 31 or equivalent. Rapid reading of Latin-American works and of Spanish books dealing with historical and social phases of Latin-American civilization; constant practice in the oral and written use of Spanish. (3) Mr. WARSHAW.

234. **Seminary in Spanish Literature.** Detailed study of some literary movement or representative writer of significance in the literary history of Spain or of the Latin-American countries, or the investigation of Latin-American social characteristics as observable in the literature of the countries involved. (2) Mr. WARSHAW.

Spanish Philology. See courses 214 and 216.

GROUP OF PHILOSOPHY AND EXPERIMENTAL PSYCHOLOGY

EXPERIMENTAL PSYCHOLOGY

These courses are open only to students who have had an introductory course in general psychology.

102a and 112b. **Experimental Problems.** (1), (2), or (3) Mr. MEYER.

108a or b. **Abnormal Psychology.** The abnormalities of mental life resulting from inborn, pathological, or artificial causes (such as idiocy, aphasia, apraxia, somnambulism, hypnosis, etc.) and their educational, medical, and forensic significance. (3) Mr. MEYER.

203a or b. **Graphology.** The manifestation of individual characteristics in peculiarities of script. Methods of identifying individual handwriting and of discovering forgeries. A reading knowledge of either French or German is required. (2) Mr. MEYER.

205a or b. **Theory of Music.** The aesthetic laws of music. The psychological differences between primitive and highly developed music and between European and exotic music. (2) Mr. MEYER.

206a or b. **Principles of Psychology.** Discussion of the general principles of scientific investigation. Application of these principles in the criticism of modern psychological theories and problems. (3) Mr. MEYER.

209a or b. **Psychological Systems.** A comparative study of the psychological systems as found in the chief text-books on psychology issued during the last thirty years. (4) Mr. MEYER.

PHILOSOPHY

103a. **Ethical Theory.** Prerequisite, sophomore standing. An introductory study of the main problems of ethics and of the chief methods of their solution, with constant reference to the principal historic schools for illustration and interpretation. The following topics will be included: the nature of ethics as a philosophical discipline; hedonism; intuitionism; utilitarianism; self-realization; the ground of obligation; conscience; freedom; egoism and altruism; optimism and pessimism. (3) Mr. HUDSON.

104a. **History of Ancient and Medieval Philosophy from the Ionian Schools to Bacon.** Prerequisite, sophomore standing. Includes a careful reading of the greater part of Plato's *Republic*. (3) Mr. HUDSON.

104b. **History of Modern Philosophy from the Renaissance to the 19th Century.** Prerequisite, sophomore standing. Properly follows course 104a, though this is not required. The development of modern systems and their relations to science and to political and social movements. (3) Mr. SABINE.

108a. **Philosophical Applications of Evolution.** Prerequisite, sophomore standing. The origin of the theory of evolution, its application outside biology, particularly in ethical theory, and its meaning and value for metaphysics. (2) Mr. SABINE.

109a. **Philosophy in the Life of the Nineteenth Century.** Not given in 1917-18. A non-technical presentation of philosophical ideas which have played a part especially in social and political movements of the nineteenth century. Mr. SABINE.

111b. **Philosophy of the State.** Prerequisite, junior standing. An historical and critical survey of theories of political obligation and political liberty. (3) Mr. SABINE.

112b. **American Ideals.** Prerequisite, junior standing. A study of the metaphysical and ethical interpretations of life implied in American social and political institutions. (3) Mr. HUDSON.

121b. **Contemporary Metaphysics.** Prerequisite, course 104b or an equivalent. Representative systems, issues, and controversies of the present day; general relations to historic philosophy. Stress is laid upon the problems and tendencies characteristically modern in their setting, such as those aroused by the development of modern science. (3) Mr. HUDSON.

122a. **Scientific Naturalism.** Prerequisite, course 104b or an equivalent. Materialism and other types of metaphysics that profess to depend in a special sense on the natural sciences; reading of Haeckel, Spencer, and others. (3) Mr. SABINE.

230a and 230b. **Seminary.** Subject to be determined. Two or three hours' credit according to the amount of work done. Mr. HUDSON; Mr. SABINE.

GROUP OF EDUCATION

110a and b. **The Psychology of Learning.** Prerequisites, an approved course in general psychology, and course 102a or its equivalent. Undertakes to work out a science of education based upon a knowledge of the child and the laws of learning. Considers the development of attention, perception, and the various mental functions. Especial attention given to the subjects of individual differences and the laws of learning as far as determined by the recent work in educational psychology. A part of the course will consist in a study of the period of adolescence. 110a, lectures, text-book and laboratory; 110b, laboratory only. (Credit to be arranged.) Mr. PYLE.

111b. **Psychological Tests.** A laboratory course in mental and physical tests, the psychology of individual differences, and the economy and technique of learning. (3) Mr. PYLE.

112a. **Abnormal and Defective Children.** A study of subnormal and supernormal children from the standpoint of genetic psychology. Examination of the causes of these deviations, tests for their determination, and a study of their proper treatment. (1) Mr. PYLE.

113a. **Current Problems.** A study of current problems in education from the point of view of psychology. Informal discussions and reports of periodical literature in educational psychology. May be elected in successive years. (1) Mr. PYLE.

114b. **Current Problems.** Same as course 113a. (1) Mr. PYLE.

121a. **Educational Classics.** An intensive study of the historical setting and content of a few educational classics which mark prominent movements in the development of educational thought and practice. (3) Mr. COURSAULT.

130a and b. **Theory of Teaching.** Aims to formulate a method of class work, and as fully as time will permit to illustrate its application to subjects in all grades of school work. (3) Mr. CHARTERS.

149. **Statistical Studies in Theory of Teaching.** Prerequisite, course 130a or its equivalent. The application of statistical methods to the testing and improvement of methods of teaching. (3) Mr. CHARTERS.

150a. **School Supervision.** A study in the principles of school supervision, in which emphasis is laid upon the relation between superintendent, supervisors, teachers, and pupils. Practical problems such as attendance, classification, government, reports, exhibits, will be briefly considered on the basis of this relation. The course consists largely of observational studies in the University schools. (2) or (3) Mr. MERIAM.

150b. **Supervision of Instruction.** A study in the principles and practice of class criticism, arranged for superintendents, principals, and supervisors in public schools and normal schools. Outlining stud-

ies, providing materials of instruction, helping pupils study, determining upon tests of efficiency are the leading problems in the course. Laboratory work is provided in the University schools. (2) or (3) Mr. MERIAM.

151. Elementary Education. A study is made of the function of the elementary school in modern life and the nature of the curriculum needed to meet this aim. Elementary problems of school management and current methods of teaching reading, arithmetic, geography, etc. are studied. This course is planned for those preparing for special work in teaching or supervising in elementary schools and includes much observation and laboratory work in the University Elementary School. (3) Mr. MERIAM.

160b. School Economy. A course in effective methods of school management from the standpoint of the teacher in secondary schools. (2) Mr. ELLIFF.

161b. School Administration. A general treatment of the important administrative problems of principals and superintendents in small city school systems, for which the class meets twice a week. The third hour of credit will be given for individual practice work in the investigation and solution of practical problems involved in the administration of the University High School, the University Elementary School, and the Columbia Public Schools. (2) or (3) Mr. ELLIFF.

163a. High School Administration. Prerequisite, courses 102a and 120 or equivalent. A consideration, from the standpoint of the administrator, of the main problems now confronting secondary education in the United States, with special reference to conditions in Missouri. The principal topics considered are: relation of high school to elementary school, college, and community; organization and direction of teaching staff; equipment; government; reorganization of curriculum with special attention to vocational training, physical education, and social life of high school; elimination of pupils; keeping, interpretation, and use of high school statistics; financing of secondary education. Open for credit only to superintendents, high school principals, and experienced high school teachers. (2) Mr. ELLIFF.

170b. Principles of Education. The purpose of this course is to give an understanding of the fundamental principles that should guide in educational practice. It culminates in a study of the principles that should guide in the selection of the course of study and in the teaching of knowledge and appreciation. Some of the other topics considered are: the relation of the individual to society; how the individual acquires purposes and ideas; the development of character and of knowledge and appreciation of the world; the natures and values of sciences, history, and fine arts; the nature of social development; the school as a social institution. (3) Mr. COURSAULT.

180a and 180b. Practice Teaching. Hours and credit must be arranged with the instructor before registration. Application should be

made in the semester preceeding that in which this course is wanted. Mr. MERIAM.

210. **Seminary in Educational Psychology.** Open only to students who have had considerable training in both education and psychology. Aims to guide advanced students in constructive work in the theory of education thru a detailed study of a few aspects of mental development. For thesis work. Credit to be arranged. Mr. PYLE.

211. **Research in Educational Psychology.** Open only to students who have had considerable training in both general and educational psychology, including training in psychological method. Original investigation of problems in mental development or in any field of educational psychology. Credit to be arranged. Mr. PYLE.

220. **Seminary in the History of Education.** A critical investigation of topics in connection with the thesis work for the graduate degrees. Mr. COURSAULT.

221b. **History of Education in the United States.** A research course for advanced students. (2) Mr. COURSAULT.

230. **Seminary in Theory of Teaching.** An intensive study of some problems in theory of teaching. The problems selected will depend in part upon the interests of the students. Considerable use is made of psychology and history of education, satisfactory work in both being prerequisite to this course. (3) Mr. CHARTERS.

231. **Research Course in Theory of Teaching.** An intensive study of certain problems in theory of teaching, the selection of which is largely dependent upon the interest of the class. Primarily for students not in residence who are working upon special problems. Credit to be arranged. (3) Mr. CHARTERS.

250. **Seminary in School Supervision.** An intensive study of problems in connection with thesis work for graduate degrees. Opportunity is offered for experimental work in the University schools. Mr. MERIAM.

251. **The Public School Curriculum.** Research work on courses of study for elementary schools and for high schools. A close examination is made of typical curricula in schools of this country and foreign countries; also curricula of especial schools. Study is made of the development of the curriculum to meet changing social and industrial conditions in community and national life and to comply more adequately with the psychological development of the pupil. (3) Mr. MERIAM.

260b. **Seminary in School Administration.** A research course in school organization and administration with special reference to city school systems. The course is to be taken only in connection with thesis work for the graduate degrees. Mr. ELLIFF.

270. **Seminary in Philosophy of Education.** An intensive study of problems in the philosophy of education in connection with thesis work for the graduate degrees. Mr. COURSAULT.

271. Philosophy of Education. This course begins with a critical study of the origin and nature of some of the traditional beliefs that seriously affect the consideration of educational problems and leads to a systematic treatment of the fundamentals of education in the light of modern science and philosophy. The ideas acquired are then used in the interpretation and criticism of a variety of modern contributions to educational thought and practice. (3) Mr. COURSAULT.

In addition to the above, a number of courses in the teaching of Botany, English, German, etc., and in the administration of school subjects are offered and may be counted as education for the degree of Master of Arts.

For a statement of these courses, see the announcement of the School of Education in the general catalogue.

GROUP OF HISTORY AND POLITICAL SCIENCE ECONOMICS

105a and b. Money, Credit, and Banking. A study of the relation of the production of the precious metals and the banking business to the supply of money and the prices of commodities. An inquiry is also made into the organization and operation of the banking business in the leading nations with special reference to its bearing on loan and discount rates and the development of business. (5) Mr. STEWART.

106a. American Transportation Problems. The theory of rate making, competition of transportation lines, transportation monopoly, discriminations and their effects, and rate regulation. Particular attention is devoted to leading decisions of the Interstate Commerce Commission. (3) Mr. BROWN.

107a. Economic History of the United States. This course traces the development of agriculture, commerce, and manufactures in the United States from colonial days to the present time, to show the historical basis of American industry and the rise of the principal economic problems of to-day. (3) Mr. WOOSTER.

108b. Financial History of the United States. The origin and development of the currency, banking, and revenue systems of the United States with special emphasis upon tariff policy and the currency system. (3) Mr. WOOSTER.

109a or b. Crises and Depressions. The recurring periods of activity and inactivity in business known as prosperity, crisis, and depression. The causes and effects of these fluctuating movements are sought by an analytical study of recent business cycles. (2) Mr. WOOSTER.

110a and 110b. Problems of Labor. A study of the special problems and interests of wage-earners, such as the organization and policies of trades-unions, employers' associations, arbitration, profit-sharing, factory acts, and other forms of labor legislation. (3) to (5) Mr. WOOSTER.

115a or b. **Public Revenues.** A critical examination of the various theories as to the limits of state activity; proportional vs. progressive taxation; the later developments in value theory as bearing on the more difficult problems of incidence; the administrative aspects of income taxation; legal and constitutional aspects of franchise and corporation taxation; the practicability of a scientific articulation of the various taxes under American conditions. (3) to (5) Mr. ROGERS.

117a or b. **Advanced Accounting.** A more intensive study of the balance sheet and income statement in their usual and special forms, taking up the different purposes and theories of assets and a detailed study of cost accounts which presents the function of accounting as a test of business efficiency. (4) Mr. SCOTT.

118a. **Corporation Finance.** Describes the purposes and methods pursued in the organization and management of business corporations and the uses and character of corporation securities as related to the investors and to the corporation's management. (3) Mr. ROGERS.

119b. **Trusts and Combinations.** The development of business organizations, the financing of such enterprises, their relations to the control of industry, the prices of commodities, and the distribution of wealth. (2) Mr. ROGERS.

120a. **Speculative Markets.** The organizations, methods, and functions of produce exchanges and securities markets and the influence of their operations upon the movement of prices. Given in alternate years. (2) Mr. ROGERS.

121b. **Accounting and Business Policy.** An intensive study of cost accounting methods, together with a summary review of the balance sheet and income statement, leading to the analysis and interpretation of annual reports of industrial corporations, with a view to showing how they may be made the guide to sound business policies. (3) Mr. SCOTT.

122a. **Investments.** A study of (a) the forms of investments—stocks, bonds, and mortgages—in regard to their suitability for the different types of investors; (b) a discussion of business cycles in relation to security prices; and (c) the use of business barometers as an aid in judging business conditions and the consequent probable movement of security prices. (2) Mr. ROGERS.

124b. **Foreign Exchange and Trade.** Given in alternate years. (a) The principles and practice of foreign exchange, including a study of drafts, letters of credit, arbitrage, movements of specie, the gold points, and peculiarities of the exchange situation growing out of the European war. (b) Shipping, finance, and sales problems; transportation costs; the theory of trade and trade regulation; tariffs, bounties, etc. (2) Mr. BROWN.

134a or b. **Public Accounting and Auditing.** The organization of accounts, state, county, and municipal; accounts of public service corporations under both public and private operation. (2) Mr. SCOTT.

136b. **Employer and Employee.** A critical study of methods and systems of hiring and handling employees in various lines of industry. Problems of employment and organization are studied from the employer's point of view. (2) Mr. WOOSTER.

138a or b. **Mercantile Organization.** Given in alternate years. An analytical study of wholesale and retail merchandising. Special types of organization, such as the manufacturing jobber, the mail order house, the chain store, and the department store, are analyzed critically from the viewpoint both of the business man and the public; and various price systems and selling policies are similarly examined. (2) or (3)

210a and 211b. **Advanced Economic Theory.** A critical examination of the writings of the leading economists from the time of Adam Smith to the present, to the end of constructing a correct theory of value and distribution. A survey of the theoretical aspects of the science. Credit to be arranged. Mr. VEBLEN.

212. **Seminaries.** Credit to be arranged. Mr. VEBLEN; Mr. BROWN; Mr. WOOSTER.

213a or b. **Statistics.** The rudiments of statistical methods based upon a study of sources and collection of statistical data, census reports, forms of averages and their proper uses, together with the graphic and tabular presentation of results. (3) See Mathematics, course 160b.

214a and 215b. **History of Economics.** A first-hand study of authors and documents, with especial reference to the background of political and industrial conditions and of philosophical thought. The student is advised to correlate this course with related courses in philosophy, political science, history, and sociology. (2) or (5) Mr. VEBLEN.

218a and 219b. **Economic Factors in Civilization.** An inquiry into institutions as affected by economic conditions with a view particularly to early European civilization. (2) to (5) Mr. VEBLEN.

HISTORY

105a. **Greek History.** Not given in 1917-1918. (3) Mr. OLMSTEAD.

106b. **Roman History.** (3) Mr. OLMSTEAD.

These two courses may be taken separately, but together they give a survey of general Ancient History. They are intended for mature students, especially prospective teachers.

110a. **The Renaissance.** A general survey of the period with special reference to its cultural aspects. (3) Mr. TRENHOLME.

111b. **The Protestant Revolt.** A general survey. (2) Mr. TRENHOLME.

112a. **Economic and Social History of Medieval Europe.** 300 to 1500. (2) Mr. WRENCH.

113b. **Economic and Social History of Modern Europe.** 1500 to the present. (2) Mr. KERNER.

These two courses may be taken separately but together they form a complete history of the social and economic development of Europe. Of especial interest to students of commerce.

115b. **Recent European History.** The political, social, economic, and institutional history of the chief European countries since 1815 will be carefully studied, with a view to present conditions. (5) Mr. KERNER.

117a and b. **English History.** Political, social, and institutional development of the English people from the earliest times to the present day. (5) Mr. TRENHOLME.

130a. **Oriental History** (to 600 A. D.). Political and social history of the early Oriental peoples of Assyria, Babylonia, Egypt, and Israel; Greece and Rome in their relations with the Orient. (3) Mr. OLMSTEAD.

131b. **Oriental History** (600-1900). A study of the political and social aspects of the rise of Islam with special emphasis on the relations between Western Asia and Europe. (3) Mr. WRENCH.

The two preceding courses, though they may be taken separately, together form a complete survey of the history of Western Asia.

135b. **History of the Hebrews.** Not given in 1917-18. The sources for Old Testament History, the religious and social development, the background for Christianity, and the later Judaism. (2) Mr. OLMSTEAD.

148a. **The Roman Empire.** Not given in 1917-18. History of Rome during the early empire with special reference to the provinces. (2) Mr. OLMSTEAD.

150a. **European Culture and Civilization—the Middle Ages.** Not given in 1917-1918. A careful study of the blending of the Graeco-Roman, German, and Christian elements of culture during the early medieval period and their later development. (2) or (3) Mr. WRENCH.

155b. **The Crusades.** Not given in 1917-1918. A course dealing in an intensive way with the crusading movement in both its western and eastern aspects. (2) or (3) Mr. WRENCH.

160a. **The French Revolution and the Napoleonic Era.** Not given in 1917-1918. Lectures, with discussion, based on text and collateral reading, on the political history of the period. (3) Mr. KERNER.

163a. **Modern Germany and Austria-Hungary.** History of the German people under the Hapsburgs and Hohenzollerns from the Reformation to the present time. (2) Mr. KERNER.

165b. **Modern Russia.** Not given in 1917-1918. A survey of the political, social, and economic evolution of the Russian Empire and its relations to Pan Slavism. Lectures, collateral reading, class discussions. (3) Mr. KERNER.

167b. **The Far Eastern Question.** Not given in 1917-1918. The modern history of China, Japan, and India, with especial reference to their relations with Europe. (2) Mr. KERNER.

170a. **Modern England and the British Empire.** A course dealing with the internal and external problems of England and the British Empire since 1660. (3) Mr. TRENHOLME.

175b. **English Constitutional History.** An advanced English history course dealing with the growth of English government and law as a background to present conditions in the British Empire and America. (3) Mr. TRENHOLME.

180b. **American Social History.** A survey of the development of American society, with emphasis on the economic and social progress since the Revolution. (3) Mr. STEPHENS.

182a. **History of the West.** A study of the westward movement of population, the economic, social, and political development of the west, and the reaction of western ideals and influences on United States history. (3) Mr. VILES.

184a. **History of the South.** Economic, social, and political development of the South. The agricultural system, with its dependence upon unfree labor and the resulting political theories, will make up the background of the course. (2) Mr. STEPHENS.

186b. **History of Missouri.** The primary aim of this course will be to give an account of the development of Missouri since 1803. (2) Mr. VILES.

190a. **American Diplomatic History.** A comprehensive view of the foreign relations of the United States, with Fish's *American Diplomacy* as a text. (3) Mr. STEPHENS.

195b. **Recent United States History.** History of the United States since 1876, from the point of view of the historical background of present day problems. (3) Mr. VILES.

210. **Seminary in Historical Research and Thesis Work.** A course giving opportunity for research and thesis work along special lines. Primarily intended for candidates for graduate degrees. The work of the student will be under the direction of the instructor most interested in the field in which the topic of special research lies. (1), (2), (3), or (4)

240. **Seminary in Ancient History.** (2) or (3) Mr. OLMSTEAD.

286. **Seminary in Missouri History.** Research in selected topics in Missouri history, 1820-1845. (3) Mr. VILES; Mr. STEPHENS.

POLITICAL SCIENCE AND PUBLIC LAW

104a. **European Governments.** A descriptive study of the constitutional organization and practical working of the principal governments of Europe, with considerable attention to political parties and current political questions. (5) Mr. SHEPARD.

105b. **Comparative Constitutional Law.** A comparative study of the legal and theoretical basis of the modern state, the various forms of government and the structure and function of the principal governmental organs. (3) Mr. SHEPARD.

106a. **Municipal Government.** A study of the organization of the cities of the United States. During the latter part of the course special topics will be taken up in more detail, such as: central control over cities, municipal elections, municipal revenue, the regulation of public utilities, and municipal ownership. (2) Mr. LOEB.

107a. **Party Government.** A study of the theory, organization, methods of action, and functions of political parties, with special emphasis on the party system of the United States. (2) Mr. SHEPARD.

108a. **State Administration.** A study of the development, organization, and functions of the executive branch of the American state governments, with special emphasis on the newer administrative agencies and the relation of the state government to contemporary economic and social problems. (2) Mr. JOURNEY.

109b. **International Law.** A general treatment of the law governing international relations in peace and war, with considerable attention to the problems arising out of the European war. (3) Mr. SHEPARD.

120b. **Problems in Municipal Administration.** A detailed study of certain specific problems in the administration of cities. (2) Mr. JOURNEY.

201a. **Administrative Law.** A study of the legal principles regulating the acts of administrative officers of the national and commonwealth governments. (3) Mr. JOURNEY.

204. **Constitutional Law of the United States.** Particular attention will be given to the field of individual liberty defined in the Constitution of the United States and interpreted in the decisions of the Supreme Court. (3 and 2) Mr. LOEB.

209b. **The Law of Taxation.** Not given in 1917-18. A study of the legal rules regulating taxation in the central and commonwealth governments of the United States. The student is advised to correlate with related courses in economics. (2) Mr. LOEB.

210a. **History of Political Theories to the French Revolution.** Not given in 1917-18. A study of the development of political thought in its relation, as cause and effect, to political action, from the period of antiquity to the French Revolution. (2) Mr. SHEPARD.

211b. **Recent and Contemporary Political Theories.** Not given in 1917-18. A study of political theory since the French Revolution and its influences upon political action. (2) Mr. SHEPARD.

212. **Proseminary; Representative Assemblies.** An intensive study of the organization, functions, and procedure of representative assemblies from a comparative point of view. (3) Mr. SHEPARD.

220. **Seminary.** Credit to be arranged. Mr. LOEB; Mr. SHEPARD.

SOCIOLOGY

110a. **Social Pathology.** Prerequisite, course 1. A general course dealing with (1) the extent and causes of social maladjustment, with particular reference to poverty and pauperism; (2) methods of ameli-

oration and fundamental social reforms; (3) the principles of relief in dependency cases; (4) charity organization and administration. (3) Mr. BERNARD.

111b. **Criminology.** Prerequisite, course 1. The nature and causes of crime; the criminal and the juvenile delinquent; penal, reformatory, and preventive methods; the indeterminate sentence, probation, and parole; the reform of criminal procedure; police methods. (3) Mr. BERNARD.

112a. **Preventive Philanthropy.** An intensive study of some specific problems in preventive work, including a study of child problems, playgrounds, child labor, and the juvenile court. Considerable time is given to the general problems of child welfare, especially those of normal child life. (2) Mr. TAYLOR.

115a and b. **Rural Sociology.** A study of social conditions in rural life and their improvement. Among the topics considered will be the statistics and movements of rural population, the physical environment of rural life, isolation and means of communication, rural occupations, co-operative organizations among farmers, the family and woman's position in rural life, the country school, the country church, leadership, etc. Lectures, assigned reading, and papers. (2) Mr. BERNARD.

116b. **Urban Sociology.** A study of social conditions in urban communities. The origin and growth of cities will be considered. An intensive study will be made of educational, political, moral, social, aesthetic, and religious forces and institutions in urban life. Municipal reform movements will be considered. Lectures, assigned reading, and papers. (2) Mr. TAYLOR.

125a. **General Anthropology.** A study of the origin and evolution of man as an animal and of the different races of mankind. The prehistoric human types, the principles of ethnology, and the characteristics of the Negro, Mongolian, American, and Caucasian races. Lectures and assigned reading. (3) Mr. ELLWOOD.

126b. **Cultural Anthropology.** A study of social origins and of the earliest stages in cultural evolution; the stone and metal ages, the origins of industry, language, magic, religion, morals, science, art, and of social organization in the family, horde, clan, and tribe. Lectures and assigned reading. (3) Mr. ELLWOOD.

220a. **The Principles of Sociology.** A critical study of sociological theory. The sociological theories of recent writers, such as Ward, Ross, Giddings, and Hobhouse, will be critically examined with a view to laying the foundations for a constructive theory of the social life in modern biology and psychology. Discussions and papers by the class. (3) Mr. ELLWOOD.

221b. **Biological Sociology.** A course on the biological basis of sociology. Among the topics treated will be the relation of organic to social evolution with special attention to heredity, selection, adaptation, and variation, the beginnings of social evolution in the animal

world, and the instinctive, emotional, and intellectual bases of association. Lectures, assigned reading, and research work. (2) Mr. ELLWOOD.

222a. **Social Statistics.** Statistical methods for the investigation of problems in social science will be studied. The principal statistical investigations that have so far been made will be analyzed, and one or more problems will be given to each student to furnish practice in quantitative treatment. Lectures, assigned reading, and research work. (2)

222b. **Methods of Social Research.** A study of methods of social investigation, including the Social Survey, the use of statistical methods, and other methods of social measurement. Concrete problems are assigned to each student for practice. (2) Mr. TAYLOR.

227a. **The Negro in America.** A study of the social, economic, moral, and educational conditions among the negroes of the United States. The work will consist of lectures, library work, and theses. Students will be admitted only after consultation. (2) Mr. BERNARD.

230b. **History of Social Philosophy.** Lectures on the development of social thought from Aristotle to the present. The social philosophies of Plato, Aristotle, St. Augustine, Thomas Aquinas, Machiavelli, Bodin, Hobbes, Locke, Vico, Montesquieu, Rousseau, Condorcet, and the sociological systems of Comte, Spencer, Shaeffle, Lilienfeldt, Gumplowicz, Ratzenhofer, and Ward will, among others, be considered. A large amount of assigned reading will be required in this course. The student is advised to correlate this course with related courses in economics, history, political science, and philosophy. (3) Mr. ELLWOOD.

231a. **History of Philanthropy and the Poor Law.** A study of the development of legislation governing and methods of administering public relief in England and America, and the parallel account of voluntary charitable institutions and methods. (2)

240. **Seminary.** Research work upon special problems in sociology and philanthropy. Two, three, or four hours' credit will be given, according to the amount of work. Mr. ELLWOOD; Mr. BERNARD.

SCHOOL OF SOCIAL ECONOMY

A training School for Social Workers. Located in St. Louis.

101a. **Problems of Poverty.** This course deals with the causes of poverty and considers at length the individual and social factors involved. It includes a discussion of the remedial agencies, both public and private, and outlines their general sphere of effort. Special attention is given to the improvement of living and working conditions, and the development of better physical and mental types. (3) Mr. MANGOLD.

102a. **Labor Problems.** A review of the social effects of the industrial revolution and of the rise of the factory system. A study of labor supply, wages, hours of labor, unemployment, labor organization, the sweating system, woman labor, minimum wage, standards and cost

of living, workmen's compensation, factory inspection, and methods of promoting the amelioration of the wage-earning classes. (3) Mr. MANGOLD.

103. **Practice of Organized Charity.** During the first semester the course deals with the problem of the social reconstruction of individuals or families. The general principles and processes of social treatment are discussed and students are familiarized with the recognized methods of dealing with broken or depressed families. In the second semester a study is made of the methods of organizations specializing in particular case problems. This course provides the fundamentals for the practical training in case work. (3) Miss KELLEY.

105b. **Neighborhood and Group Work.** A course designed to train students for effective work in handling groups in settlements, social centers, and in the welfare departments of stores and factories. The principles and methods underlying such work are studied and practical activities are required of the students. (3) Miss WILDER.

106a. **Charitable Institutions.** This course contemplates visits to each type of institution studied, a discussion of the problems of management, and the consideration of physical, sociological and administrative standards. (3) Miss KELLEY; Special Lecturers.

108b. **Crime and its Treatment.** This course embraces a discussion of the physical and social causes of crime, the various schools of criminology, the police, the criminal courts, court procedure, jails, reformatories and penal systems, indeterminate sentence, adult probation, the cost of crime, and measures of prosecution. Special problems of the woman offender are considered. (2) Mr. MANGOLD.

109b. **Child Welfare.** This course begins with the study of heredity and environment as social factors. Then the problems of infant and child mortality, protection from disease, the playground movement, and the social aspects of education, including truancy, retardation, and industrial training are briefly discussed. Attention is given to child labor problems, juvenile delinquency, the probation system, reformatory institutions, measures of child protection, the dependent and neglected child, and child caring agencies, public and private. (3) Mr. MANGOLD.

111b. **Race Problems.** The course deals with the problems of immigration and discusses sources, social, economic, and political effects, methods of assimilation, immigration legislation, and effect on national character. A program of the work by public and private agencies to promote the Americanization of the immigrant is reviewed and a program of betterment is outlined. (3) Miss WILDER.

112b. **Race Problems.** A brief study is made of the negro, with special reference to St. Louis. The economic, social, and educational problems are considered. (1) Miss WILDER.

113a. **Social Activities of Cities.** The object of this course is to familiarize the student with those branches of municipal government

that deal with the social problems of the city, to analyze their operations, to understand their scope and purpose, and to relate their activities to those of the private agencies in the community. Special attention is given to cities that have developed departments of social welfare. The effect and value of improvements in governmental machinery are also discussed. (3) Mr. MANGOLD.

204. **Methods of Social Research.** A course dealing with the principles and practice of social investigations with practical work on a number of selected problems. The methods of inquiry used by state, federal, and private agencies are studied, and the value and validity of selected reports examined. Direct information is gained in regard to wages, cost of living, movement of population, birth rate, marriage and divorce, and other problems. (3) Mr. MANGOLD; Miss WILDER.

212b. **Organization and Function of Social Agencies.** A discussion of the functions and actual work of typical agencies such as charity organizations, anti-tuberculosis, children's aid, public health, and county welfare societies. Methods of co-operation through central council or federation, bases for a division of the field, problems of extension of service, and related questions are considered. (3) Mr. MANGOLD.

215. **Seminary.** Research course for special investigations and thesis work. (2-4) Mr. MANGOLD.

In addition to the above courses, practice work is required of every candidate for a degree.

GROUP OF MATHEMATICAL AND PHYSICAL SCIENCES

ASTRONOMY

102a. **Geodetic Astronomy.** Prerequisite, civil engineering, course 102. Determination of azimuth, time, latitude and longitude with the engineer's transit. (3) Mr. BAKER.

103b. **Practical Astronomy.** Prerequisite, course 1 and trigonometry. An introduction to the theory and use of astronomical instruments. Use of ephemerides. (3) Mr. BAKER.

105b. **Modern Astronomy.** Prerequisite, course 1. A study of the problems and aims of modern astronomical science; its relation to other sciences. Frequent references to current literature of astronomy. (3) Mr. BAKER.

106a or b. **Advanced Astronomy.** Prerequisite, course 102a, 103b, or 105b. Subjects are selected to meet the requirements of the individual students. Credit to be arranged. Mr. BAKER.

108b. **Theoretical Astronomy.** Prerequisite, 103b and calculus. Integration of equations of motion. Determination of parabolic and elliptic orbits; construction of ephemerides. Application to comets, planets, and binary stars. (3) Mr. BAKER.

209a. **Astrophysics.** Application of physical principles to astronomy. Methods and results, with their bearing on solar and stellar phenomena. (3) Mr. BAKER.

210b. **Stellar Photometry.** Theory and use of photometric apparatus. Investigation of stellar magnitudes and their variation, by visual and photographic methods. (3) Mr. BAKER.

220. **Research.** Opportunity for original investigation is offered to qualified students. Credit to be arranged.

CHEMISTRY

101a and b. **Advanced Inorganic Chemistry.** Prerequisites, courses 27a or b and 111. Lectures and recitations. (3) Mr. MARDEN.

102a and b. **Advanced Inorganic Chemistry.** An advanced laboratory course. May be taken with course 101a and b. (1), (2), or (3) Mr. MARDEN.

110a. **Organic Chemistry.** Prerequisite, ten hours' work in chemistry; medical students will be admitted to this course with eight hours chemistry. Required in the School of Medicine and in Chemical Engineering. (3) Mr. CALVERT; Miss DOVER; Mr. WALDRON.

111b. **Organic Chemistry.** Continuation of course 110a. Required in the School of Medicine and in Chemical Engineering. (3) Mr. CALVERT; Miss DOVER; Mr. WALDRON.

112a or b. **Preparation of Organic Compounds.** A laboratory course in synthetic organic chemistry. May be taken with courses 15a, 15b, and 111. According to amount of laboratory work done (2) or (3) Mr. CALVERT; Miss DOVER.

113a or b. **Preparation of Organic Compounds and Organic Analysis.** Laboratory course. According to amount of work elected (3), (4) or (5) Mr. CALVERT.

121. **Quantitative Chemical Analysis.** Prerequisite, course 27a or b. The general principles of gravimetric and volumetric analysis. A continuous course, but it may be begun in either semester. (3) Mr. GIBSON; Mr. HAINES.

122a. **Technical Analysis.** Prerequisite, course 121. Required of chemical engineers. Gas, water, and fuel analysis. (3) Mr. GIBSON.

125a. **Quantitative Organic Analysis.** Must be preceded or accompanied by course 121. Quantitative analysis of commercial organic products, such as alcohols, aldehydes, organic acids, glycerine, oils and fats, carbohydrates, petroleum products, soaps. (3) Mr. CALVERT.

126b. **Quantitative Organic Analysis.** A continuation of course 125a. (3) Mr. CALVERT.

127a and b. **Advanced Qualitative Analysis.** Prerequisite, course 27a or b. The complete qualitative analysis of rocks, minerals, slags, and alloys. (2) Mr. GIBSON.

128a and b. **Advanced Qualitative Analysis.** Prerequisite, 127a or b. The qualitative detection of some of the less common elements and the qualitative analysis of inorganic commercial products. (2) Mr. GIBSON.

131a. **Physical Chemistry.** Prerequisite, a college course in physics, three hours of quantitative analysis, and three hours of organic chemistry. Stoichiometry of gases, liquids, and solids; solutions and the theory of ionization; thermochemistry; the phase rule; chemical equilibrium. (5) Mr. SILL.

133b. **Electrochemistry.** Prerequisites, same as 131a. Electrochemical measurements; electrolytic preparations; electrode potential and theory of electromotive force; technical electrolytic processes. (5) Mr. SILL.

135a or b. **Radioactivity.** Prerequisites, undergraduate courses in physics and chemistry. Radioactive types of matter and atomic disintegration. An introductory course. (3) Mr. SCHLUNDT.

141a. **Industrial Chemistry.** Prerequisites, courses 27a or b and 111. Application of chemistry to the purposes of human life, as illustrated in the more important arts and industries having a chemical basis for their principal operations and processes. Fuels, water, acids, fertilizers, cements, glass, pottery, paints, gas, explosives, metals, alloys. (3), (4), or (5) Mr. BROWN.

142b. **Industrial Chemistry.** Prerequisites, same as for course 141a. Starch, glucose, sugar, fats, oils, soaps, dyes, and other industries. (2) or (3) Mr. BROWN.

151a or b. **History of Chemistry.** Prerequisites, courses 111 and 131. May be taken with course 131. (3)

200. **Chemistry of the Rare Earths.** Prerequisite, course 121. Occurrence, distribution, properties, and uses of the rare earths. (3) Mr. BROWN.

211a. **Advanced Organic Chemistry.** Prerequisite, course 111. Lectures on selected topics (such as heterocyclic compounds, stereoisomerism, carbohydrates, etc., supplemented by reading and reports on classical researches. (3) Mr. CALVERT.

212b. **Advanced Organic Chemistry.** Prerequisite, course 111. Lectures on selected topics, supplemented by reading and reports on classical researches. In the selection of the subjects the special needs of the students will be considered. (2) or (3) Mr. CALVERT.

221. **Advanced Quantitative Analysis.** Prerequisite, course 121. Chiefly laboratory work. The complete quantitative analysis of rocks, ores, minerals, slags, and various commercial materials and products. The work of the course is varied to meet the needs of the individual. Credit to be arranged. Mr. GIBSON.

232a or b. **Advanced Physical Chemistry.** Prerequisites, courses 131 and 121. Lectures on selected topics, supplemented by reading and reports on classical researches. A reading knowledge of German and French is very desirable. Credit to be arranged. Mr. SCHLUNDT.

260. **Seminary.** Meetings at which subjects of a chemical interest are discussed by students of sufficient attainment and members of the teaching staff. A reading knowledge of French and German is desirable. (1)

271. **Research.** Research is offered in the following lines of work: general, organic, analytical, physical, electro- and radio-chemistry, and micro-metallography. Arrangements for research should be made by consultation with the instructor with whom the research is elected.

The University of Missouri Section of the American Chemical Society meets monthly. Students may attend these meetings.

GEOLOGY AND GEOGRAPHY

100a. **Economic Geology.** Prerequisite, course 1a or b, or 2a or b. Deals with coal, oil and gas, clays, building stones, cement materials, gypsum, fertilizers, and various minor products. Their geographic distribution, mode of occurrence, uses, origin, and conservation are studied. The department has a good collection of these products which are studied in the laboratory. Field trips to mines and quarries near Columbia. (3) Mr. TARR.

101b. **Economic Geology.** Prerequisites, course 1a or b, or 2a or b, and elementary chemistry. Considers the deposits of gold, silver, copper, iron, lead, zinc, aluminum, and minor metals; their geographic distribution, mode of occurrence, origin, uses, production, and conservation. (3) Mr. TARR.

102a. **Advanced Physiography.** Prerequisite, course 1a or b, or 2a or b. A lecture, text-book, and conference course intended for those who wish to do advanced work in geology and for those who expect to teach physiography in secondary schools. The method will be topical and considerable reading will be required. (3-5) Mr. BRANOM.

103b. **Historical Geology.** Prerequisite, course 1a or b. Hypotheses for the origin of the earth, principles of sedimentation, distribution and kinds of rocks of each geologic period, geographic changes of the North American continent, causes for geographic changes, climate of each period. Several field trips. (3) Mr. BRANSON.

104a. **Geologic Life Development.** Prerequisite, course 1a or b, and a course in zoology. Changes that have taken place in the life of the earth from its first appearance to the present and the causes for these changes. The life of each geologic period is considered as a whole and in its relation to the life of the preceding and following periods. In the laboratory, students examine specimens that illustrate the gradual evolution toward living types. (3) Mr. BRANSON.

105. **Field Course.** Prerequisite, 5 hours of geology. Offered in the summer session. Intended as preparatory for advanced work in geology and as a basis for the teaching of geology and physical geography. The field work consists of mapping the areal geology, describing the sedimentary formations, igneous and metamorphic rocks, col-

lecting in a systematic way from the formations, and reporting on the structural geology, physiography, and economic products of a small area in Colorado or Wyoming. Special topics are assigned to graduate students, and this work may form the basis for masters' or doctors' theses.

(8) Mr. TARR.

106a. **Mineralogy.** Prerequisite, course 1a or b, or 2a or b. Elements of crystallography based upon lectures and work with models and crystals. Physical and chemical properties of minerals; detailed descriptions of their mode of occurrence, geographic distribution, and origin. In the laboratory, after preliminary preparation with the elements, unknown minerals are given the student for determination.

(5) Mr. TARR.

107b. **Petrology.** Prerequisite, courses 106a, 108b, inorganic chemistry, and general physics. Principles of optics as applied to the polarizing microscope, optical properties of the rock-forming minerals, microscopic and megascopic study of the various rock groups. (5) Mr. TARR.

108b. **Rocks and Rock Minerals.** Prerequisite, course 1a or b, or 2a or b. A study of the various kinds of common rocks and of the minerals that constitute them. A field classification is followed in the laboratory and the methods pursued are those which would be used in the field. The lectures deal with the origin, geologic features, economic properties, and weathering of rocks. Designed for those who wish a general knowledge of rocks as well as for geologists, engineers, architects, agriculturists. (3) Mr. TARR.

111b. **Field Geology.** Topographical and geological surveying carried on in the vicinity of Columbia. Offered as field training for geologists, topographers, civil engineers, and soil surveyors, or students who intend to take up work of this kind. (1 or 2) Mr. BRANSON.

200b. **Geology of Oil and Gas.** Prerequisites, course 1a or b, or 2a or b, and 100a, 103b, and 108b. Occurrence, origin, and methods of accumulation of oil and gas. Location of wells; development of oil and gas properties; oil and gas fields of North America. (3) Mr. TARR.

202a. **Stratigraphic Geology.** Prerequisite, courses 103b and 104a. Lectures, map work, and field work on the stratigraphy of North America, with more intensive study of a limited area. (5) Mr. BRANSON; Mr. GREGER.

203b. **Paleontology.** Prerequisite, course 104a; zoology of invertebrates and comparative anatomy of vertebrates are desirable antecedents. A somewhat detailed study of a few of the main groups of invertebrates or vertebrates with reference to their evolution and distribution previous to the present period. The content of the course will be varied to suit the needs of individual students. (5) Mr. BRANSON; Mr. GREGER.

204. **Seminary.** Geological literature and history. (1 or 2) Mr. BRANSON; Mr. TARR.

205. **Research.** Offered by members of the department in their respective lines.

206a. **Missouri Stratigraphy.** Field excursions to type stratigraphic sections in Missouri. Collections and reports. (1 or 2) Mr. BRANSON.

207b. **Economic Geology and Petrology of Missouri.** Field excursions to regions of important economic deposits. Collections and reports. (1 or 2) Mr. TARR.

GEOGRAPHY

109a and b. **Geographic Literature.** A reading course for students capable of doing semi-independent work. Reading may be along several lines, pedagogical, regional, economic, historical. Written reports required. (3-5) Mr. BRANOM.

110a. **Geography of North America.** Prerequisite, fifty hours of college credit, or course 1a or b, or 6a. Physical features, climate, plant life, animal life, and mineral resources of the continent; their influence on the distribution of population, localization and development of industries, development of transportation, growth of cities, and the historic development of the various countries. (3) Mr. BRANOM.

112b. **Geography of Europe.** Prerequisite, fifty hours of college work, or course 1a or b, or 6a. Relation of Europe to other continents; influence of location, area, topography, and climate on its development; character, distribution, and use of natural resources. Progress of different countries compared. Political boundaries and geographic conditions underlying European affairs. (3) Mr. BRANOM.

MATHEMATICS

It is especially recommended that students intending to specialize in mathematics should take courses in French and German in the preliminary work; but an extensive knowledge of the literatures of those languages is not necessary.

Before electing any of these courses, the student should consult the instructor. Except where noted, the calculus is a prerequisite.

Courses 100a and 101b are prerequisite to all courses above 200 except 205 and 251.

100a and 101b. **Second Course in Calculus.** Will treat critically problems already discussed in the earlier courses in calculus, as well as other topics not touched upon before. This course should be taken by all wishing to specialize in mathematics. (3) Mr. WESTFALL.

105a or b. **Advanced Algebra.** Prerequisite, courses 2 and 4. This course will include determinants, theory of equations, and applications of algebra to geometry. (3)

110a and 115b. **The Historical Development of Mathematics.** Designed as an introduction to higher courses in mathematics and as a comprehensive view of the whole subject for students who will not pursue mathematics further. (3) Mr. AMES.

120a. **Differential Equations and Their Applications.** Prerequisite, course 7 or special permission. Supplementary topics to the calculus will be taken up, with especial attention to the elements of differential equations. (3) Mr. INGOLD.

125b. **Differential Equations and Their Applications.** This course is a continuation of 120a, but may be elected separately by students with a grade of E or S in course 6 or its equivalent. (3) Mr. INGOLD.

130a. **Applications of Analysis.** A study of the differential equations, the series, and the integrals most essential to the mathematical sciences. (3)

150a and 151b. **Graphical Analysis.** Graphical computations, such as construction of rational functions, solution of differential equations, construction of graphical tables, and a treatment of certain topics of analysis. (1)

155a or b. **Mathematics of Business and Insurance.** Prerequisite, course 1 or its equivalent. The fundamental methods and computations involved in annuities, depreciation, sinking funds, stock and bond calculations; especial attention to the theoretical and mathematical aspects of the different phases of insurance. (3) Mr. WESTFALL.

160a or b. **Probabilities and Statistics.** Prerequisite, course 1 or its equivalent. Fundamental elementary topics in the theory of probabilities, including the theory of least squares, statistical methods, applications and illustrations from social and biological sciences, with assignment of special problems to suit the need of the student. (3) Mr. WESTFALL.

200a or b. **Seminary.** The members of the staff will conduct work in reading and research in private with students prepared for such work. The nature and amount of the work done may vary materially. The course may be elected repeatedly in different semesters for different work and for any number of hours sanctioned by the instructor.

205a or b. **Modern Algebra.** The nature of the course is best indicated by such reference books as Weber's *Algebra* and Bôcher's *Higher Algebra*. (3)

210a or b. **Differential Geometry.** Introduction to the theory of modern differential geometry. Reference books: Eisenhart; Joachimstahl; Wilczynski; Bianchi. (3)

215a or b. **Projective Geometry.** Lectures, supplemented by reading. Reference books: Emch; Veblen and Young; Reye; Scott. (3)

220a or b. **Fourier's Series and Allied Series.** Problems from Byerly's *Fourier's Series and Spherical Harmonics*, reading, and lectures on orthogonal sets of functions. (3) Mr. KELLOGG.

225a or b. **Potential Function.** Properties of potential functions; boundary value problems; and applications. Lectures, supplemented by reading. (3) Mr. KELLOGG.

230a and 231b. **Theory of Functions of Real Variables.** Higher analysis, including the most important features of mathematical analysis. Lectures, supplemented by reading. (3)

240a and 241b. **Theory of Functions of Complex Variables.** Theories of Riemann, Cauchy, and Weierstrass, in their elementary phases. Theory of functions of a complex variable; elliptic functions. (3) Mr. HEDRICK.

251a or b. **Seminary in Actuarial Science.** Advanced investigations in actuarial and allied problems. Hours to be arranged.

260a or b. **Theory of Groups, with Application to Galois' Theory and Lie's Theory.** Lectures. (3)

280a or b. **Calculus of Variations.** Theory of maxima and minima for functions defined on a general range. Emphasis is laid on the applications. References to Hadamard, Bolza, and other treatises. (3)

The following courses are offered occasionally, when the needs of the student seem to warrant:

235a and 236b. **General Theory of Functions.** (3)

255a or b. **Theory of Differential Equations.** (3)

265a or b. **Theory of Numbers.** (3)

270a or b. **Analytical Mechanics.** (3)

275a or b. **Partial Differential Equations of Mathematical Physics.** (3)

Mathematical Clubs. The students of the department conduct, for the discussion of mathematical topics, a club to which all persons interested are eligible. The members of the staff of the department hold regular meetings for the discussion of current literature and of recent research, which are open also to qualified graduate students.

PHYSICS

Students intending to specialize in physics should also take mathematics. Even in the less mathematical courses some knowledge of calculus is of great advantage.

114a. **Mechanics.** Prerequisite, 3a and 4b. Calculus also is prerequisite, unless it be taken concurrently. One or two hours of 106a may be elected to advantage along with this course. (3) Mr. STEWART or Mr. REESE.

110b. **Electricity and Magnetism.** This course is not mathematical in the same sense as courses 205-221; still it contains some theoretical work. Students desiring laboratory work in connection with this course can elect one or two hours of course 107. Lectures and recitations. (3) Mr. RENTSCHLER.

112a. **Heat.** (3) Mr. JAUNCEY.

113b. **Light.** (3) Mr. REESE.

These courses are open to those who have completed courses 3a and 4b or the equivalent. Recommended to those who either intend to teach in high schools or desire work more general in character and less mathematical than courses 205, 206, 207, and 215. The work is largely descriptive, but contains some theoretical work in which an elementary knowledge of calculus is desirable though not essential.

The course in heat includes some thermodynamics, one of the fundamental branches of Physics. Students desiring laboratory work in connection with these courses may elect one or two hours from course 108b or 106a.

The following three courses consist entirely of laboratory work. Any one of them must be preceded either by courses 1 and 2 or by 3a and 4b. They offer training in the more exact methods of laboratory measurements:

106a. Mechanics and Heat. In mechanics, angular motion, acceleration of gravity, conservation of momentum, moment of inertia, elasticity, etc., are studied; in heat, such things as specific heats, heats of combustion, vapor densities, and different methods of measuring high and medium temperatures. Work in mechanics or in heat, or in both, may be selected to suit the individual needs of the student. (1) or (2) Mr. REESE.

107a and b. Electricity. This course is much the same as the laboratory work in course 104a. (1), (2), or (3) Mr. RENTSCHLER.

108b. Light. Measurements of wavelengths by interference methods, determinations of refractive indices, study of polarization and the resolving power of optical instruments, etc. (1) or (2) Mr. REESE.

109a or b. Advanced Work in General Physics. This course, largely laboratory work, will be adapted to meet the needs and attainments of individual students. A student may be assigned a definite problem, the literature of which must be studied and the experimental work performed with the care of original research. (1), (2), (3), or (4) Mr. STEWART; Mr. REESE; Mr. RENTSCHLER.

104a. Electrical Measurements. Two lectures and three laboratory periods. In the lectures is given an introduction to the mathematical theory of electricity and electrical measurements. The laboratory work consists of such work as comparisons of resistances by Kelvin double bridge and Carey Foster methods; determination of temperature coefficients; comparison of electromotive forces of cells; various uses of the potentiometer; comparison and absolute measurement of the coefficients of self and mutual induction; calibration of ammeters and voltmeters; photometric work with incandescent lamps. (3), (4), or (5) Mr. RENTSCHLER.

117b. Spectroscopy. Open to those who have had courses 1 and 2 or courses 3a and 4b. A practical course in the use of various forms of spectroscopes and the applications to physical problems. (2) Mr. REESE.

118a or b. X-rays and High-frequency Currents. Prerequisite, 8 hours of physics. In the lectures are discussed in a nonmathematical manner the phenomena of vacuum discharges, cathode rays, positive rays, thermions, and the production of high-frequency currents. (1) Mr. RENTSCHLER.

121b. Electrical Waves. Theory and applications. (2) Mr. STEWART.

Courses 205, 206, 207 and 215 are courses in mathematical physics:

205. **Theory of Light.** Prerequisites, calculus and two years work in physics. Some attention is given to geometrical optics, the major part is devoted to the electromagnetic and electronic theories. Lectures and recitations. (3) Mr. STEWART.

207. **Theory of Electricity and Magnetism.** Prerequisite, calculus and two years of physics; differential equations recommended. Fundamental concepts and vector equations of the electromagnetic field. Electron theory. Radiation. Relations between electricity and matter. Atomic theories. Lectures and recitations. (3) Mr. STEWART.

Courses 205 and 207 will not both be given in the same year.

206. **Thermodynamics.** Lectures on the classical thermodynamics with its application to the theory of heat radiation and certain branches of physical chemistry and electricity. The more modern views based on atomic theories are also taken up, and the student is introduced to statistical mechanics. Differential and integral calculus are prerequisite, and an understanding of the more general principles of mechanics is desirable. (3) Mr. REESE.

215. **Dynamics.** Introduction to the fundamental principles of mathematical physics. (3) Mr. REESE.

Courses 206 and 215 will not both be given in the same year.

210. **Seminary.** Critical reading and discussion of current research work in physics. A colloquium in which all members of the teaching staff of the department and students of sufficient attainments take part. (1)

211a or b. **Research Work.** Hours to be arranged. Mr. STEWART; Mr. REESE; Mr. RENTSCHLER.

225a and b. **Recent Developments in Experimental Physics.** Lectures and demonstrations. (1) or (2) Mr. RENTSCHLER.

226. **Recent Developments in Theoretical Physics.** Lectures and assigned readings. (2) Mr. REESE.

GROUP OF BIOLOGICAL SCIENCES

ANATOMY

102a. **Gross Anatomy.** The study of the gross anatomy of the human body, with the exception of the central nervous system. (10) Mr. CLARK; Mr. BATSON; Mr. CHAPMAN.

103b. **Normal Histology.** The study of the microscopic anatomy of the tissues and organs of the human body. (6) Mr. JOHNSON; Mr. APPEBY.

104b. **Neurology.** The study of the gross and microscopic anatomy of the central nervous system and sense organs. (3) Mr. JOHNSON; Mr. CHAPMAN.

105a or 105b. **Topographic Anatomy.** Prerequisite, course 102a. A study of the topography of the various organs with the aid of serial sections through the body. Laboratory. (2) Mr. CLARK; Mr. JOHNSON.

106b. **Study-Room Course in Anatomy.** Prerequisite, course 102a. Each year certain of the dissected parts of the human body are preserved and are available for informal study. This may be combined with a study of cross sections. Mr. CLARK.

206a and 207b. **Advanced Anatomy.** Prerequisite, course 102a, 103b, or 104b. Advanced work will be given in any of the special fields of anatomy, the amount and character of which will be varied to suit individual needs. Mr. CLARK; Mr. JOHNSON.

208a and 209b. **Research.** Problems of original investigation will be assigned in anatomy, histology, or embryology. A reading knowledge of French and German is required. Hours to be arranged. Mr. CLARK; Mr. JOHNSON.

BOTANY

100a. **Plant Physiology.** Lectures and laboratory work on the physiology of the common cultivated plants, covering such topics as absorption, transpiration, synthesis of carbohydrates and proteins, digestion, translocation, respiration, growth, reproduction, and the reaction of plants to stimuli. (5) Mr. REED.

101b. **Ecology of Seed Plants.** Prerequisite, course 14b. The relation of plants to their environment, including a discussion of the origin, development, structure, and succession of plant formations. (2) Mr. MANEVAL.

102a. **Plant Pathology.** Courses 3a or b and 100a are desirable prerequisites. Life histories of important parasitic fungi and their pathological effects upon the host; isolation of parasites, technique of culture methods, and inoculation of the host. (3) Mr. REED.

103b. **Advanced Plant Pathology.** A continuation of the work as outlined under course 102a, which is prerequisite. Special emphasis on particular groups of diseases. (2) or (3) Mr. REED.

104a. **Histological Methods.** Methods used in the preparation and preservation of class material and in fixing, sectioning, and staining of sections for microscopical study. (2) Mr. DURAND.

105. **Comparative Morphology and Embryology.** Structure and life history of selected representatives of the great groups of green plants. Special attention will be given to tracing the development and homologies of sterile, sporogenous, and reproductive parts, such as the formation of spores and gametes, fertilization, the development of the embryo. (3) Mr. DURAND.

106b. **Plant Breeding.** The study of the cell as the unit of structure and function, and as the physical basis of heredity. Particular emphasis upon the fundamental principles of plant breeding including hybridization, Mendelian phenomena, etc. (3) Mr. REED.

107b. **Problems in Plant Physiology.** Prerequisite, course 100a. Lectures and discussions on physiological problems. The work in any given semester is confined to some special topic as mineral nutrients,

photosynthesis, respiration, etc. Laboratory work on the subject considered may be elected for additional credit. (2-5) Mr. REED.

108b. **Diseases of Forest Trees.** Prerequisite, course 102a. Required of students in forestry. A study of the fungous diseases of forest trees, the fungi which cause decay in timber, and the methods of timber treatment. (3) Mr. REED.

111a. **Special Problems.** On consultation with the teachers concerned, properly prepared students may take up special problems in the various fields of Botany. Credit to be arranged. Mr. REED; Mr. DURAND; Mr. MANEVAL.

112b. **Special Problems.** See statement under 111a.

200. **Seminary.** Special subjects of botanical work will be taken up and discussed, including the results of investigations carried out in the department. A reading knowledge of French and German is essential. (1) Mr. REED.

201a. **Research.** Students who have had adequate preparation will be assigned some special problem for investigation. A reading knowledge of French and German is essential. Credit and hours to be arranged. Mr. REED; Mr. DURAND; Mr. MANEVAL.

202b. **Research.** See statement under 201a.

PATHOLOGY

201a or 201b. **Advanced Pathology.** The amount and character of the work will depend upon the needs and qualifications of the student. In connection, opportunity will be afforded for practical experience in the handling of all kinds of morbid material. Hours to be arranged. Mr. DOLLEY; Mr. SIMMONS.

202. **Research.** Opportunity is offered to students sufficiently prepared for original investigation of unsolved problems in the fields of pathology and pathological physiology. A reading knowledge of German is required and French is recommended. A seminary is held once a week. Mr. DOLLEY.

203. **Normal and Abnormal Neurocytology.** The application of the general principles and theories of biology to the nerve cell in health and disease. The work will necessarily consist largely of original investigation and will be adjusted to the training of the student. Hours to be arranged. Mr. DOLLEY.

204a. **Pathological Physiology.** An experimental course. (2) Mr. DOLLEY; Mr. SIMMONS.

PHYSIOLOGY

101a. **General Physiological Chemistry.** Prerequisite, Chemistry, course 111 or equivalent. Physiological chemistry of the carbohydrates, fats, and proteins; of the cell and special tissues; of the blood; of respiration; of metabolism; of secretions and excretions; and a

quantitative study of the urine in relation to diet. (4) Mr. GULICK; Mr. HARVEY.

102a. **Physiology of Secretion, Metabolism, and Reproduction.** The physiology of secretory processes, digestive mechanics, absorption, excretion, respiration, metabolism and energy exchange, heat regulation, and reproduction. (2) Mr. GREENE; Mr. BROWN; Mr. ROBNETT.

103a. **Experimental Physiology.** The physiology of circulation, respiration, muscle and nerve, nervous system, and sense organs. (6) Mr. GREENE; Mr. BROWN; Mr. ROBNETT.

104a and 104b. **Advanced Physiological Chemistry.** A course supplementing and extending course 101a. The preparation and chemistry of the proteins; a qualitative and quantitative study of the tissues and secretions, of enzymes, of putrefaction and putrefactive products; analyses of typical foods; and the detection of food preservatives and adulterants. The prosecution of a short investigation and formal report on the same are required. (2-4) Mr. GULICK.

105b. **Pharmacology.** The physiological action of drugs from the experimental point of view. The demonstrations are made on man and the lower animals. (4) Mr. GREENE; Mr. BROWN; Mr. ROBNETT.

107b. **Toxicology.** Prerequisite, course 104a or 105b. (2 to 3) Mr. GULICK.

109b. **Physiology of Development and Growth.** Prerequisite, elementary physiology, 1a or 1b, or equivalent. A course of lectures and assigned reading, with special emphasis on factors that influence the capacities of the developing nervous system. (2) Mr. GREENE.

206a. **The Physiology of the Nervous System.** (3) Mr. GREENE.

208. **Journal Club.** (1) Mr. GREENE.

209a. **The Physiology and Pharmacology of the Circulatory System.** (3) Mr. GREENE.

210a and 210b. **Advanced Physiology.** Advanced courses in physiology, physiological chemistry, and pharmacology. Individual problems will be assigned to students of sufficient preparation. Hours to be arranged. Mr. GREENE; Mr. GULICK.

211. **Investigation.** Opportunity is offered for research into questions of current physiological interest. Mr. GREENE; Mr. GULICK.

PREVENTIVE MEDICINE AND BACTERIOLOGY

102b. **Medical Bacteriology.** Prerequisite, Botany, course 3a or 3b. Subjects studied include: relation of bacteria to disease; the fundamental principles of immunity, serum diagnosis, serum and vaccine therapy. The different diseases are discussed, and the micro-organisms causing them are studied in the laboratory, with animal inoculations and demonstrations. The course includes also the study of the most important diseases caused by protozoa. (4) Mr. RAVENEL.

201a and b. **Advanced Bacteriology.** Prerequisite, course 102a. Amount and character of work will depend on needs and qualifications

of student. The manufacture of autogenous vaccines, the determination of the opsonic index, making and use of various sera, and the study of milk and water are among the subjects suggested. Hours to be arranged. Mr. RAVENEL.

202. **Research.** Prerequisite, course 102a. Students who are sufficiently prepared will be given problems requiring original investigation in the fields of bacteriology and public health. A reading knowledge of French and German recommended. Hours to be arranged. Mr. RAVENEL.

203. **Conduct of Public Health Laboratories.** Prerequisite, courses 102a and 201a. Designed for those who expect to take up such work as a profession or for teaching purposes. Graduates in medicine preferred. The collection and shipment of various specimens, their examination, milk and water problems, etc. will be discussed and the practical work carried out in the laboratory. Hours to be arranged. Mr. RAVENEL.

ZOOLOGY

100a. **Zoology of Invertebrates.** A comparative study of invertebrates. May be taken advantageously by students who expect to teach zoology. (5) Mr. CURTIS; Mr. MUTKOWSKI.

101a. **Embryology of Vertebrates.** Designed to lay the foundation of vertebrate embryology. Successive stages in the development of the frog, the chick, and the pig are studied from preparations of entire embryos and from serial sections. These observations are used as a basis of comparison for the study of human embryology. (3) Mr. LEFEVRE; Mr. TANNREUTHER.

102a. **Animal Ecology.** A course dealing with the principles of ecology and including a study of the structure, activities, life-histories, distribution, and evolution of animals. (3) Mr. DODDS.

103b. **Cytology.** A study of the cell, with special reference to problems of development and inheritance. Cytological technique. (5) Mr. LEFEVRE.

104a. **Genetics and Evolution.** A course of lectures dealing with the experimental study of genetics and its relation to problems of organic evolution. Emphasis is laid on the phenomena of Mendelian inheritance and the cellular mechanism of heredity. (2) Mr. LEFEVRE.

105a. **Protozoology.** A study of the biology of protozoa, with emphasis upon their relation to vertebrates; methods of culture and general technique. Of special interest to students of medicine and agriculture. (2 or 3). Mr. CURTIS.

106b. **Parasitology.** A study of the fundamental principles of parasitology; life histories and behavior of animal parasites; effects produced upon their hosts by parasites. Of special interest to students of medicine and agriculture. (2 or 3) Mr. CURTIS.

107a. **Comparative Histology.** A comparative study of the microscopic structure of animal tissues and organs. Microtechnique. (3) Mr. DODDS.

120a and 121b. **Special Problems.** Preparation for research in zoology. Hours to be arranged. (3) Mr. LEFEVRE; Mr. CURTIS; Mr. DODDS; Mr. MUTKOWSKI.

200. **Research.** A reading knowledge of French and German is essential. Investigation of unsolved problems of zoology, in which the student is trained in the exercise of original observation and thought. Hours to be arranged in accordance with the requirements of individual students.

201. **Seminary.** A reading knowledge of French and German is desirable. Meetings at which subjects of zoological investigation are discussed by instructors and students. Each student is required to give at least four lectures during the year, and experience is thus gained in presenting, in the form of lectures, the results of reading and research. (1).

HISTORY OF ART

111a. **History of Italian Renaissance Painting.** Lectures and collateral reading. Critical study of representative pictures by means of the best available reproductions. (3) Mr. PICKARD.

112b. **History of Renaissance Painting in the Netherlands and in Germany.** Lectures and collateral reading. Critical study of representative pictures by means of the best available reproductions. (3) Mr. PICKARD.

113. **Masterpieces of Architecture, Sculpture, and Painting of Classical, Renaissance, and Modern Times.** Lectures fully illustrated with the stereopticon. Aims to show the historical development of art by the discussion of some of the finest examples in each of the three divisions mentioned. (1) Mr. PICKARD.

216. **Seminary in the History of Art.** Hours and work to be assigned. Mr. PICKARD.

As supplementary to all courses offered in the history of painting and of sculpture, Introduction to Art (Theory and Practice of Art) is recommended.

For courses in Classical Archaeology and Art, see page 8.

THEORY AND PRACTICE OF ART

103. **Theory of Design.** Prerequisite, course 2a or 2b or its equivalent. The study of design as an art activity fundamental to the fine arts and crafts and as a basis for art criticism. The problems of pure design; the relation of the art product to its environment; the relation of the esthetic to other factors in the work of art; the application of the principles of design to definite problems. Two lectures and one laboratory period a week. (3) Mr. ANKENY; Mr. CARR.

104. **Architecture.** Prerequisite, course 2a or 2b, while course 103 is advised in addition. A study of the essentials of architecture with stress laid on the meaning of architecture to society. Lectures and recitations and laboratory. Study of examples with original exercises in composition. (3) Mr. WELCH.

105. **Pictorial Composition.** Prerequisite, course 4 or courses 2a or 2b and 103. Exception may be made to students possessing technique of photography. Study and practice in the making of pictures. (2) Mr. CARR.

106. **Painting.** Prerequisite, course 4, while course 103 is advised in addition. Style, theory, and method as exemplified in some of the important schools and movements. Lectures, study of examples, and reading. Experimental practice in painting in several of the principal modes. (3) Mr. ANKENNEY.

107. **Tone.** An advanced painting course. Two periods a week will be given to work directly under the instructor, in addition to which the student will be expected to paint a great deal alone, bringing in the work for criticism. (3-5) Mr. ANKENNEY.

108. **Life.** An advanced drawing course. Drawing and modeling the figure from life. (3-5) Mr. ANKENNEY.

202. **Problems of Design.** Prerequisite, course 103 and, possibly, 104 or 106. Advanced problems in some field of design. (2-5) Mr. ANKENNEY; Mr. WELCH.

204. **Problems of Form.** Not given in 1917-18. Prerequisite, course 108. An investigation of various theories of representation. (2) Mr. ANKENNEY; Mr. CARR.

206. **Design in Relation to Drama.** Prerequisite, courses 103 and 105. Study of the pictorial problems of the stage. (2) Mr. CARR.

208. **Traditions of Painting.** Prerequisite, courses 103, 105, and 106. An investigation into the processes of the old masters with the adaptation of their traditions to modern work. (2-3) Mr. ANKENNEY.

231. **Problems in the Teaching of Art in Secondary Schools and Colleges.** Not given in 1917-18. In this course every possible opportunity will be given the student to conduct original investigation in some phase of this field. (2-5) Mr. ANKENNEY.

HOME ECONOMICS

101a. **House Sanitation.** Prerequisite, physiology, bacteriology, or preventive medicine. A study of the situation, ventilation, heating, lighting, water supply, drainage, and care of the house with reference to health, convenience, and cost. Public sanitation, as it relates to the household, is considered. (3) Miss KNEELAND.

110b. **House Planning and Furnishing.** Prerequisite, course 101a; preceded or accompanied by design. A study of the planning and furnishing of the house from the standpoint of convenience, economics, health, and art. The type of house is considered in relation to sur-

roundings, materials used, size, cost, and adaptability to special needs of the family. House plans are studied and the equipment and decoration of each room is considered in detail, convenience and cost being especially emphasized. Each student plans and furnishes a house to suit certain definite conditions. (3) Miss RONZONE.

120a. Food and Nutrition. Prerequisite, organic chemistry, physiology, bacteriology, home economics 11b. A study of the chemistry of the foodstuffs and their occurrence in the different food materials; the digestion, absorption, and utilization of the foodstuffs, and the digestibility of different food materials and combinations; the preservation and adulteration of foods.

Laboratory work in chemical analysis and digestion experiments is related to work in food preparation and preservation. (5) Miss KNEELAND.

121b. Dietetics. Prerequisite, course 120a and its prerequisites. A study of normal food requirements and the nutritive value of different food materials and combinations. Dietaries are planned to meet definite conditions, and the meals prepared and served. The cost of the dietary and the relation between nutritive value and cost is emphasized. A special study is made of infant feeding, the feeding of children, and school lunches. (3) Miss KNEELAND.

130a. Metabolism and Dietetics. Prerequisite, course 121b and its prerequisites. A consideration of the process of metabolism with particular attention to the elimination of metabolic end-products and their significance. The amount of food required to maintain the body in health is considered and the factors that determine this amount are worked out. Abnormal metabolic processes are considered as they throw special light on the problems of dietetics. (5) Miss STANLEY.

151. The Clothing Problem. Prerequisite, course 51 or 52, physiology, and organic chemistry. A study of the selection, construction and care of clothing for the infant, child, and adult from the hygienic, social, and economic standpoints. This includes a study of the textile fabrics, their characteristics, manufacture, and cost, and the problem of household linens. (3) Miss RONZONE.

152. Advanced Clothing. Prerequisite, course 151 and design. A continuation of course 151, with special application of the principles of hygiene, economics, sociology, and art to the costume. (3) Miss RONZONE.

200. Home Economics Seminary. The most recent work in various lines of home economics will be reviewed and discussed. The line of work considered will be changed each semester so as to cover the field as comprehensively as possible. Open only to especially prepared seniors and graduates. (1) Miss STANLEY.

201. Research in Food Preparation. Special problems in the field of food preparation will be taken up for investigation. Open only to those who have had course 120 and chemistry 25a and b or its

equivalent. A knowledge of French and German is desirable. Miss STANLEY; Miss KNEELAND.

220b. **Problems in Nutrition.** Prerequisite, course 121a. An intensive study will be made of special problems of interest in nutrition. Each student will investigate a nutritional problem in the laboratory and write a report upon same. Credit according to amount of work done. Miss STANLEY.

250. **Research in Clothing.** Open only to those who have had all the undergraduate courses in clothing with their prerequisites. A study of the problems involved in the hygiene and economics of the clothing supply. A reading knowledge of French and German is desirable. Credit according to the amount of work done. Miss RONZONE.

GROUP OF AGRICULTURE

AGRICULTURAL CHEMISTRY

101a and b. **Advanced Agricultural Chemistry.** A continuation of the regular undergraduate course in agricultural chemistry, which is required of all undergraduate students in agriculture. A critical study of methods in use in the chemical laboratories of the experiment station will be made, including an examination of foods and feeding stuffs for adulteration, etc. Three to five periods per week, including one lecture or recitation each week. Hours to be arranged. Mr. TROWBRIDGE; Mr. HAIGH; Mr. MOULTON.

201a and b. **Seminary.** (1) Mr. TROWBRIDGE.

202a and b. **Research.** May be elected either as major or minor and may include a thesis showing the results of the investigations. The chemical laboratories offer exceptional facilities for research. Subjects may be selected in (a) animal nutrition; (b) composition of animal fats as affected by feeding, age, breed, etc.; (c) the composition of meats, feeding stuffs, fertilizers, soils, etc.; (d) the chemical problems involved in the dairy industries; (e) the distribution of phosphorus in the animal organism with special reference to the separation of phosphorous compounds; (f) chemical problems involved in the enforcement of state and national pure food laws; (g) the separation of proteins of flesh and study of their hydrolytic cleavage products. (3-5) Mr. TROWBRIDGE; Mr. HAIGH; Mr. MOULTON; Mr. PALMER.

203a. **Chemistry of the Proteins.** A critical study of the composition and classification and of the decomposition products of the meat and vegetable proteins. Lectures and recitations. (3) Mr. TROWBRIDGE.

204a. **Physiological Chemistry of the Domestic Animal.** Designed to meet the requirements of students fitting themselves for investigations in animal nutrition. (3) Mr. PALMER.

ANIMAL HUSBANDRY

200. **Seminary.** Special investigation bearing on selected lines in animal husbandry. The preparation and presentation of papers for discussion by the class. (1) Mr. MUMFORD; Mr. TROWBRIDGE; Mr. ALLISON.

201. **Experimental Feeding.** Original investigations of important problems of feeding cattle, sheep, and swine. This course is intended to give experience in methods of experimental work and to make the student familiar with the most approved methods of investigation. (2) Mr. TROWBRIDGE; Mr. ALLISON.

202. **Research in Animal Husbandry.** Advanced studies of special phases of animal production. Recommended to students who desire more thorough training in the production of cattle, horses, sheep, or swine, or who may wish to make a more careful study of the fundamental principles of animal husbandry. Mr. MUMFORD; Mr. TROWBRIDGE; Mr. ALLISON.

203. **Animal Breeding.** Research in special subjects bearing on the inheritance and development of characters in the domestic animals. Mr. MUMFORD.

204. **Zoometry.** Special investigation of the relations of form and function in the domestic animals. Mr. TROWBRIDGE.

205. **Research in Stock Farm Management.** Investigations of the principles governing successful systems of stock farm management. Special studies of highly efficient stock farms. (2) Mr. MUMFORD; Mr. TROWBRIDGE; Mr. ALLISON.

DAIRY HUSBANDRY

100b. **Milk Production.** The breeds of dairy cattle; selection, breeding, and development of a dairy herd; care and management of dairy cattle; feeding for milk production; production of certified and market milk; milk for butter-making and cheese-making; utilization of by-products of the dairy. Mr. ECKLES.

201. **Seminary.** The object of this course is to train the student to do independent work and to develop the spirit of research. It consists of special investigation and study along selected lines of research with review and discussions of recent work. Each student presents papers on selected topics and reports on recent scientific investigations and on current literature of the subject. Mr. ECKLES.

202. **Research in Dairy Husbandry.** A large herd of highly developed dairy cattle representing four breeds makes it possible to offer facilities for study and investigation of a variety of subjects pertaining to milk production and the care and management of dairy cattle. Students interested in this line are allowed to carry out certain experiments with the dairy animals and in some cases to assist in lines of

investigation under way in the Agricultural Experiment Station. Mr. ECKLES.

203. **Special Investigations in Dairy Chemistry.** The chemical composition of milk, butter, cheese, etc., and the factors influencing their composition offer many attractive problems for graduate research. Unusual facilities are offered graduate students of good training in organic or agricultural chemistry to carry on independent investigations along the lines mentioned. The results obtained are usually of such a character that they can be published in one of the chemical journals. Mr. PALMER.

204. **Dairy Bacteriology.** This will be laboratory investigation of certain problems of bacteriology in relation to dairying, the object being chiefly to give training in methods of research in this line. The work will be adapted largely to the individual student. Mr. ECKLES; Mr. WERNER.

205. **Dairy Manufactures.** Opportunity and facilities are given to study and investigate problems in butter-making, cheese-making, and other lines of dairy manufactures. Mr. ECKLES; Mr. RINKLE.

ENTOMOLOGY

110b. **Advanced Economic Entomology.** A study of the insects of economic importance with special reference to those affecting horticultural crops, live stock, farm crops, the household, and man himself. Emphasis is placed on the study of the life history, injury, and methods of controlling them. (3) Mr. HASEMAN.

111a. **Morphology, Histology, and Development of Insects.** A technical study of the development of the insect from the egg to the adult. Special emphasis is placed on the study of the different tissues of the insect's body, the origin and development of the different structures of both the immature and the mature insect, and the changes the insect undergoes. In the laboratory the student is required to give special attention to the preparation of material for sectioning, the manipulation of the microtome, and the staining, mounting, and studying of serial sections. Lectures and laboratory work. (3) Mr. HASEMAN.

200a and b. **Research.** Opportunity is offered for original investigations in economic entomology, systematic entomology, and insect morphology. Mr. HASEMAN.

201a and b. **Seminary.** Reviews of current literature and reports on original investigations are presented and discussed by the students and members of the faculty. (1) Mr. HASEMAN.

FARM CROPS

101a. **Cereal Crops.** Prerequisite, course 1a or b. An advanced course dealing with the history, characters, adaptation, culture, uses, and distribution of the principal cereal crops, based largely on a study of literature and experimental data. Laboratory study of the

principal types and varieties. Two lectures and one laboratory period a week. (3) Mr. ETHERIDGE; Mr. McDONALD.

102a. **Forage Crops.** Not given in 1917-18. Prerequisite, course 1a or b. An advanced course dealing with the history, character, adaptation, culture, use, and distribution of the principal forage plants. Laboratory study of the principal types and varieties. Based largely on a study of literature and experimental data. Two lectures and one laboratory period a week. (3) Mr. HELM.

103b. **Fiber Crops.** Prerequisite, course 1a or b. An advanced course dealing with the history, distribution, culture, character, harvesting, marketing, use, and improvement of the principal fiber crops, with special reference to cotton. (2) Mr. ETHERIDGE.

104b. **Field Crop Improvement.** Prerequisite, courses 101a and 102a. A study of the laws of variation and heredity, the theory of mutation, the pure line theory, and Mendelism, as applied to the breeding of the principal farm crops. Laboratory studies in the inheritance of characters and the use of statistical methods in measuring variation, correlation, and heredity. (3) Mr. ETHERIDGE; Mr. HELM.

105. **Special Problems.** By permission. Primarily for advanced undergraduates who show proper preparation. Topics will be assigned or may be chosen subject to approval. Hours by appointment. Mr. ETHERIDGE; Mr. HACKLEMAN; Mr. McDONALD; Mr. HELM.

201. **Research.** By permission. Original research in problems pertaining to the production, management, and improvement of farm crops. Hours by appointment. Mr. ETHERIDGE.

202. **Seminary.** By permission. Discussion of various phases of investigations pertaining to the production, management, and improvement of farm crops. Papers on assigned topics and reports on recent investigations and current literature on the subject are presented by the student. Required without credit of graduate students majoring in Farm Crops. (1) Mr. ETHERIDGE.

FARM MANAGEMENT

112a. **Farm Records.** Prerequisite, course 105a. A detailed study of the results of record work—what the records reveal in the way of successful or unsuccessful management and methods. (2) Mr. GREEN.

113b. **Farm Administration.** The application of the principles gathered in course 110b; making detailed and balanced plans for special farms and considering the handling and management of crops and stock under those special conditions. (2) Mr. JOHNSON.

151b. **Special Problems in Farm Administration.** Prerequisites, courses 105a, 110b, 112a, and 114s. A detailed study of the organization of, and practices followed on, an approved farm, made by means of detailed records. A thesis showing a comprehensive grasp of the organization of the farm business and some of the problems of manage-

ment, together with detailed cost data for the farm year, will be required. Mr. JOHNSON; Mr. GREEN.

152a. A continuation of 151b, which is a prerequisite to the course. Mr. JOHNSON; Mr. GREEN.

200. **Seminary.** Selected literature and special field investigations of farm management problems, to be used as the basis for original outlines, and detailed plans for improving systems of farming. Mr. JOHNSON; Mr. GREEN.

201. **Investigation of Types of Farming.** Field investigations of the different types of farming occurring in a given region, including careful and detailed study of farm practices and incomes. Thesis required. Mr. JOHNSON.

202. **Investigation of Cost of Production and the Distribution of Labor.** Field investigations of the comparative cost of producing farm products and the distribution of labor on Missouri farms. Thesis required. Mr. JOHNSON; Mr. GREEN.

205. **Agricultural Statistics.** A study and interpretation of agricultural statistics and their application to present day agricultural problems, planned especially for students who expect to take up experiment station work. Material from the census, bureau of statistics, weather bureau, agricultural surveys, various experiment station publications and other statistical reports will be used. Mr. JOHNSON.

207. **Investigation of Systems of Farm Organization and Farm Practices.** A study of systems of farm organization with emphasis on the details of this organization made by means of agricultural surveys and detailed cost accounting records. Thesis required. Mr. JOHNSON.

HORTICULTURE

105a. **Advanced Pomology.** The study of the principal species, types, and varieties of cultivated fruits and their related forms, together with a consideration of their variation, modifications, and adaptations under culture. The living plant collection on the horticultural grounds and a large number of varieties, types, and grades of apples, together with other varieties of fruits both in a fresh and a preserved state, afford material for study of types and varieties for exhibition and marketing purposes. (3) Mr. LAWRENCE; Mr. WHITTEN; Mr. WIGGANS.

107. **Plant Materials.** Trees, shrubs, and vines. Practical course designed to familiarize the student with the character, habits, and adaptation of ornamental trees, with special reference to their use in cities, parks, and private estates. This course is especially designed to train students for the positions of park superintendent, city forester or warden, nurseryman, or landscape plantsman and includes tree shaping and surgery, practicum and field work. Hours by appointment. (2) Mr. MAJOR.

115. **Special Problems.** Primarily for advanced undergraduates. Topics will be assigned to students who show proper preparation.

Hours by appointment. Mr. LAWRENCE; Mr. WHITTEN; Mr. MAJOR; Mr. WIGGANS.

200. **Special Investigation.** For graduates and advanced students. Special problems for investigation will be assigned. Hours by appointment. Mr. LAWRENCE; Mr. WHITTEN; Mr. MAJOR; Mr. WIGGANS.

SOILS

101a. **Advanced Soil Fertility.** Prerequisite, course 1a. An advanced course dealing primarily with soil fertility. Designed for students wishing a more complete knowledge of soils than can be secured in course 1a. The laboratory exercises include work on soils of special interest such as those from the experiment station plots or from the home farms of the students. One lecture and two laboratory periods. (3) Mr. MILLER; Mr. HUDELSON.

102b. **Soil Surveying.** Prerequisite, course 1a. A course designed to familiarize the student with the methods and actual practice of detailed soil survey work. The work consists of the preparation of soil maps of areas near Columbia, the sampling of the soil types, the mechanical analysis of samples taken, and the preparation of a soil survey report on the area. Two practicums a week. (2) Mr. HUDELSON; Mr. KRUSEKOFF.

103b. **Soil Investigations.** Prerequisite, course 1a or b, and course 101a. A study of methods of soil investigation and the carrying out of investigations on assigned soil problems. Particular attention is given to methods and results of investigations in the United States and Europe. One lecture and two laboratory periods a week. (3) Mr. MILLER; Mr. HUDELSON.

104a. **Soils of the United States.** Prerequisite, course 1a. A course designed to familiarize the student with the general classes of soils thruout the United States, their characteristics, crop adaptations, and the systems of soil management adapted to each. (2) Mr. MILLER.

105a. **Soil Bacteriology.** Prerequisite, course 1a or b, and general bacteriology. Lectures and laboratory work relating to the micro-organic life of the soil in its various activities, such as decay of crop residues and manures, nitrogen changes, including denitrification, ammonification, nitrification, nitrogen fixation by legume bacteria and other organisms, soil inoculation, sulphur transformations, and general processes biologically related to the plant food supply in soils. One lecture and two laboratory periods. (3) Mr. ALBRECHT.

200. **Seminary.** Discussion of various phases of soil investigation. Papers on assigned topics are presented for discussion. A reading knowledge of French and German is recommended. (1) Mr. MILLER.

201. **Soil Research.** Original investigations in soils. The special work undertaken is determined by the preparation and needs of the student. (2-10) Mr. MILLER.

VETERINARY SCIENCE

201. **Topographic Veterinary Anatomy.** Prerequisite, course 1a. A study of the topographic anatomy of the horse, ox, and pig by means of serial cross-sections of preserved cadavers, supplemented by a study of anatomical surface points on the living subject.

This course is designed to meet the needs of advanced students who intend to specialize in animal husbandry along the lines of stock judging and meat production. (3) Mr. CONNAWAY.

202. **Contagious, Infectious, and Parasitic Diseases of Farm Animals.** In this course an effort is made to present as many clinical cases as possible, in order that the student may gain a practical knowledge of the clinical features as they are encountered in field experience. Experimental inoculations supplement the clinical study. Autopsies are made and the gross and microscopic lesions studied. The specific causes (bacteria and other micro-parasites and macro-parasites), where known, are isolated and studied. Such ground relating to this group of diseases as has been well covered in the minor course 3a is not repeated in this course. Text and reference books: Hutyra and Marek's *Veterinary Pathology*; Law's *Vet. Med.*, IV; Ostertag and Wilcox's *Meat Inspection*; Neumann's *Parasites and Parasitic Diseases*; Nocard and Leclainche's *Les Maladies Microbiennes des Animaux*; Kitt's *Bacterienkunde*; Herzog's *Disease Producing Microorganisms*. Special bulletins and veterinary journals. Lectures, assigned reading, clinics, and laboratory work. (3) Mr. CONNAWAY.

203. **Investigation.** Students who have suitable preparation will have an opportunity to assist in the agricultural Experiment Station work. Studies on immunity in relation to hog cholera, infectious abortion in cattle, and roup in chickens will be continued during the coming session. (6) Mr. CONNAWAY.

GROUP OF ENGINEERING

CHEMICAL ENGINEERING

For the courses in Chemical Engineering see Chemistry, courses 110a, 111b, 121, 131a, 133b, 141a, 142b.

CIVIL ENGINEERING

105b. **Geodetic Surveying.** Elements of geodesy, with practice in use of precise instruments and reduction of triangulation. (3) Mr. WILLIAMS.

114a. **Railway Maintenance.** Maintenance of track; signals; organization of engineering department; accounting. (3) Mr. MILLER.

115b. **Railway Yards and Terminals.** Arrangement of terminal facilities for handling of both passenger and freight business; design,

construction, and operation of yards of several kinds and types. (2) Mr. MILLER.

123b. **Higher Structures.** Swing bridges; arches; suspension and cantilever bridges; deflection of trusses. (3) Mr. HYDE.

126a. **Concrete Structures.** Theory of reinforced concrete structures with problems in design. (3) Mr. SPALDING.

143a. **Irrigation and Drainage.** Irrigation engineering, institutions, and practice; canals; ditches; reservoirs; land drainage. (2) Mr. RODHOUSE.

144b. **Rivers and Canals.** River improvements, training works, floods, levees, dredging, shore protection; waterways, canals and locks; river discharge. (2) Mr. RODHOUSE.

157b. **Sanitation and Sanitary Design.** General sanitation; garbage reduction; street cleaning; design of works for sewage disposal and water purification. (2) Mr. McCAUSTLAND.

201. **Geodesy and Precise Surveying.** Credit to be arranged. Mr. WILLIAMS.

211. **Railway Engineering.** Advanced course in construction, maintenance, and operation. Credit to be arranged. Mr. MILLER.

221. **Structural Engineering.** Special problems in advanced design. Credit to be arranged. Mr. HYDE.

222. **Concrete Structures.** Theory and design of concrete structures; special laboratory investigations. Credit to be arranged. Mr. SPALDING.

223. **Theory of Structures.** Statically indeterminate structures; secondary stresses. Credit to be arranged. Mr. HYDE.

231. **Experimental Investigation.** Hydraulic laboratory. Laboratory investigations concerning the properties and uses of the materials of construction. Credit to be arranged.

241. **Hydraulic Engineering.** Problems in hydraulics, irrigation, river and harbor improvements; hydraulic construction. Credit to be arranged. Mr. RODHOUSE.

251. **Sanitary Engineering.** Investigations and special problems in sanitary engineering. Credit to be arranged. Mr. McCAUSTLAND.

ELECTRICAL ENGINEERING

131b. **Electric Motors.** Prerequisite, course 101. Construction, characteristics, and application of electric motors to various classes of service. Comparison between electric and other methods of drive as to costs of installations, operating expenses, flexibility, convenience. (2) Mr. WEINBACH.

132a. **Storage Battery Engineering.** Prerequisite, course 102a. Theory, operating characteristics, and application of electric storage batteries; problems in the economic considerations of standby service, load equalization, and vehicle work. (2) Mr. WEINBACH.

133a. Illumination. Prerequisite, course 101. Characteristics of commercial types of electric lamps and their application to interior and exterior lighting. Problems in design of lighting systems from the standpoint of cost and satisfactory operation. (2) Mr. SAVANT.

134b. Telephony. Prerequisite, course 110a. Design and operation of telephone systems. Electrical transmission and reproduction of speech. Propagation of high-frequency, alternating currents in cables and overhead lines. Switchboard systems, manual and automatic. Types of line construction. Telephone traffic studies; facilities required. A few periods are devoted to laboratory work. (2) Mr. SAVANT.

140b. Central Station Design. Prerequisite, course 130a. Selection and arrangement of equipment of electric power plants. Each student takes up a specific problem, plans and designs a power plant, giving complete specifications, estimates of cost, recommendations of business extension, and methods of operation. (2) Mr. LANIER.

141b. Electric Railway Engineering. Prerequisite, course 110a. Electric railway systems; equipment and operation. Economic conditions governing the construction of an electric road. Methods of determining costs of equipment; determination of probable gross earnings, fixed charges, operating expenses, maintenance. (2) Mr. SAVANT.

142b. Transmission. Prerequisite, course 130a. Transmission of electric power. Line regulation. Economical aspects, practical limitations, operating precautions. Surges; protective apparatus against disturbances originating in the various parts of the system. (3) Mr. WEINBACH.

143a. Electrical Processes. Not offered in 1917-18. Prerequisite, course 101. Miscellaneous practical applications of electricity in electro-chemical and metallurgical industries, including electroplating; electric welding; the theory, construction, and operation of electric furnaces. (2) Mr. WEINBACH.

144b. Analysis of Design Problems. Not offered in 1917-18. Prerequisite, course 121a. An analysis of some of the more important problems relating to the design of electrical machinery. Discussions of approximations made in formulating the problem and of the limits within which such approximate methods may be used. Such problems will be discussed as: heat flow and heat dissipation in electrical apparatus; commutation; flux distribution in magnetic fields of various forms; analysis of irregular waves; dielectric stress in electrical apparatus; leakage reactance; armature reaction; critical design study of electrical apparatus and controlling devices for typical industrial applications. The work will be presented in the form of a series of problems for solution and discussion by the student. (2) Mr. LANIER.

150a. Special Electrical Laboratory. This course will be adapted to meet the attainments of individual students. Definite problems will

be assigned which must be studied by existing literature and by experimental work. (2) Mr. LANIER.

180b. **Applications of Mathematics to Electrical Engineering.** Prerequisite, mathematics, course 6. Stating the problem in mathematical form; approximate solutions; derivations of empirical formulæ; solutions of equations by graphical methods; application of complex numbers, exponential functions, and differential equations to electrical engineering problems. (2) Mr. WEINBACH.

290. **Research.** Original investigations along various lines in electrical engineering. Students taking research work will have as advisers those members of the staff most conversant with the problem undertaken.

MECHANICAL ENGINEERING

138a. **Boiler Design.** Design, construction, and operation of steam-boilers. Studies of increased rates of heat transmission and probable future boiler practice. Credit to be arranged. Mr. HIBBARD.

172a or b. **Engineering Charts.** Prerequisite, Mechanics. Theory and construction of charts for purpose of expediting solution of formulas frequently used in physics, civil, mechanical, and electrical computations. Use of logarithms and logarithmic paper. (1) Mr. FOSTER.

201b. **Special Machine Design.** Advanced work in kinematics, graphics, materials, and the design of apparatus and machinery for specific work. Credit to be arranged. Mr. HIBBARD; Mr. FOSTER.

211a. **Shopwork Engineering, B.** Prerequisite, course 111 or course 112. Advanced analyses in production-engineering. Shop betterment. New mechanisms in efficiency management. Motion-studies. (2) Mr. HIBBARD.

221a and b. **Special Mechanical Laboratory.** Advanced work in experimental engineering research. Tests of steam, gas, and water power-producing machinery, steam-boilers and furnaces, bituminous coal gas-producer. Complete plant tests. Locomotive tests. Combustion engineering. Tests on the experimental lathe and in commercial shops. Studies of the uses and development of indicating and recording apparatus as a means of obtaining and retaining increased operating efficiencies. Credit to be arranged. Offered by members of the staff in their respective lines.

234. **Gas Engineering.** Prerequisite, machine-design, either heat engines or thermodynamics, A. Production, preparation, transmission, and use of industrial gases, together with the theory and practice of internal-combustion motors. (2) Mr. WHARTON.

251a. **Refrigeration, B.** Prerequisite, elementary thermodynamics, preceded or accompanied by steam machinery, and course 154a. Designs plans, specifications, estimates for one or more selected studies as ice factory, cold-storage, district refrigeration, nursery, market, etc. Re-

search, tests, improvements, appraisals, sales, management. Credit to be arranged. Mr. WHARTON.

261b. **Railway Mechanical Engineering.** 1. Locomotive design, divided into boiler-plant, carriage, and steam-engine. Compounding, superheat, articulated. 2. Locomotive operation; service, maintenance, fuels, locomotive-terminals; testing; train-resistance. 3. Car design. 4. Railway shop: layout, design, equipment, and operation of central shops for the general repair of locomotives and cars. Credit to be arranged. Mr. HIBBARD.

MECHANICS

112. **Advanced Mechanics.** Problems in dynamics. (3) Mr. DEFOE.

205. **Elasticity.** Mathematical theory of elasticity. (3) Mr. DEFOE.

209. **Hydrodynamics.** Mathematical theory of the motion of fluids.

(2) Mr. DEFOE.

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Assistant Professor of History.
- HORACE FAIRCHILD MAJOR, B. S. A.,
Assistant Professor of Landscape Gardening, and Superintendent
of Grounds.
- JOHN WESLEY MARDEN, B. S., M. S., D. Sc.,
Assistant Professor of Chemistry.
- ELMER M. McDONALD, B. S.,
Assistant Professor of Farm Crops.
- CHARLES ROBERT MOULTON, B. S. in Ch. E., M. S. in Ag., Ph. D.,
Assistant Professor of Agricultural Chemistry.
- LEROY SHELDON PALMER, B. S. in Ch. E., A. M., Ph. D.,
Assistant Professor of Dairy Chemistry.
- WILLIAM HENRY PYLE, A. B., Ph. D.,
Assistant Professor of Educational Psychology.
- JAMES WALTER RANKIN, A. B., A. M., Ph. D.,
Assistant Professor of English.
- LORIN GEORGE RINKLE, B. S., M. S.,
Assistant Professor of Dairy Husbandry.
- GILBERT CAMPBELL SCOGGIN, A. B., A. M., Ph. D.,
Assistant Professor of Greek and Comparative Philology.
- LOUIS SELBERT, A. B., A. M.,
Assistant Professor of Romance Languages.
- FRANK FLETCHER STEPHENS, Ph. B., Ph. M., Ph. D.,
Assistant Professor of American History.
- CAROLINE TAYLOR STEWART, A. B., A. M., Ph. D.,
Assistant Professor of Germanic Languages.
- WILLIAM ARTHUR TARR, S. B., S. B. in Min. Eng., Ph. D.,
Assistant Professor of Geology and Mineralogy.
- JACOB WARSHAW, A. B., A. M., Ph. D.,
Assistant Professor of Romance Languages.
- MENDEL PENCO WEINBACH, A. B., B. S. in E. E., A. M.,
Assistant Professor of Electrical Engineering.
- HARVEY ALDEN WOOSTER, A. B., A. M., Ph. D.,
Assistant Professor of Economics.
- JESSE ERWIN WRENCH, A. B.,
Assistant Professor of History.
- WILLIAM ALBERT ALBRECHT, A. B., B. S., M. S. in Agr.,
Instructor in Soils.
- MENDEL EVERETT BRANOM, M. S.,
Instructor in Geology.
- HILLIER McCLURE BURROWES, A. B., A. M.,
Instructor in English.

MICHAEL C. CARR,

Instructor in Theory and Practice of Art.

GIUSEPPE CHERUBINI, A. M.,

Instructor in Romance Languages.

MARY VIOLETTE DOVER, A. B., M. Sc., Ph. D.,

Instructor in Chemistry.

EMIL FREDERICK HACKER, A. B., A. M.,

Instructor in French.

GEORGE EARL MACDONALD JAUNCEY, B. Sc., M. S.,

Instructor in Physics.

ROCKWELL CRESAP JOURNEY, A. B., A. M.,

Instructor in Political Science.

HILDEGARDE KNEELAND, A. B.,

Instructor in Home Economics.

WILLIS EDGAR MANEVAL, Ph. B., M. S., Ph. D.,

Instructor in Botany.

DANIEL CARROLL McEUEEN, A. B., A. M.,

Instructor in English.

RICHARD ANTHONY MUTTKOWSKI, A. B., Ph. D.,

Instructor in Zoology.

ALFRED HENRY NOLLE, A. B., B. S. in Ed., A. M., Ph. D.,

Instructor in Germanic Languages.

JAMES HARVEY ROGERS, B. S., A. B., A. M., Ph. D.,

Instructor in Economics.

ETHEL RONZONE, B. S., A. M.,

Instructor in Home Economics.

DOM. PETER SAVANT, B. S. in E. E., M. S., E. E.,

Instructor in Electrical Engineering.

DR SCOTT, A. B., B. S. in Jour.,

Instructor in Economics.

HERBERT FOWLER SILL, M. S., Ph. D.,

Instructor in Chemistry.

RALPH RAYBURN SIMMONS, A. B., A. M., M. D.,

Instructor in Pathology.

GEORGE WASHINGTON TANNREUTHER, A. B., A. M., Ph. D.,

Instructor in Zoology.

AUSTIN HUBBARD WELCH, B. S. in M. E., M. E., B. Arch.,

Instructor in Architectural Drawing.

CLEO CLAUDE WIGGINS, B. S. in Agr., A. M.,

Instructor in Horticulture.

JAMES ROY WHARTON, B. S. in M. E., M. E.,

Instructor in Mechanical Engineering.

FELLOWS AND SCHOLARS, 1916-17

University Fellows:

LUCILE ARMER CARTER, A. B., Butler College, A. M., University of Missouri,
Greek.

LUCILE STARR CRAVEN, A. B., Lombard College, A. M., University of Illinois,
Latin.

LINWOOD TAFT, B. S. in Ed., University of Missouri, A. M., University of Missouri,
Education.

LOUIS FRANCIS THOMAS, B. S., Denison University,
Geology.

Gregory Fellow:

ERWIN ELLIS NELSON, B. S., Drury College, A. B., University of Missouri, A. M., University of Missouri,
Physiology.

Peabody Fellow in Education:

ARLIE GLENN CAPPS, B. S. in Ed., University of Missouri.

University Scholars:

DANIEL HEBER HOLLOWAY, B. S. in Ed., University of Missouri,
Political Science.

ISADOR LUBIN, A. B., Clark College,
Economics.

MYRTA ETHEL MCGINNIS, A. B., University of Missouri,
English.

ETHEL MOORE, A. B., University of Missouri,
English.

EDNA GLYDE RUSK, A. B., University of Missouri,
History of Art.

FRED ROY YODER, A. B., Lenore College, A. M., University of North Carolina,
Sociology.

Gregory Graduate Scholars:

JULIA EATON, A. B., University of Missouri,
English.

CLARA LOIS LHAMON, A. B., Drury College,
Home Economics.

Agricultural Research Fellows:

JOHN IRA HARDY, B. S., Rhode Island State College, M. S. in Agr.,
University of Tennessee,
Agricultural Chemistry.

FRANK JAMES KELLEY, B. S., University of Pennsylvania,
Dairy Husbandry.

U. S. Department of Agriculture Research Fellow in the Improvement of
Cereal Crops:

HARLAN RANDOLPH SUMNER, B. S., Kansas State Agr. College,
Agricultural Research Scholars:

LEON CHAPMAN DENNIS, A. B., A. and M. College of Texas,
Horticulture.

DABNEY STEWART LANCASTER, A. B., University of Virginia, M.
S., Virginia Polytechnic Institute,

Animal Husbandry.

WARD HANSON SACHS, B. S., Illinois Wesleyan University,
Soils.

CALENDAR FOR 1917-18

1917

Summer Session

June 7 Thursday, registration
 June 8 Friday, organization of classes
 June 9 Saturday, regular class work begins
 August 3 Friday, examinations

First Semester

September 13, 14, 15. Thursday, Friday and Saturday, entrance examinations

September 17, 18, 19. Monday, Tuesday and Wednesday, registration

September 19 Wednesday, 11 a. m., opening convocation

September 20 Thursday, 8 a. m., class work in all divisions begins

October 31 Wednesday, to } First term, two-year winter

December 21 Friday } course in agriculture

November 29 Thursday, Thanksgiving Day, holiday

December 21 Friday, 4 p. m., to } Christmas holidays

1918

January 3 Thursday, 8 a. m. }

January 2 Wednesday, to } Second term, two-year winter

February 21 Thursday } course in agriculture

January 21 Monday to }

January 28 Monday } Mid-year examinations

Second Semester

January 29 and 30.. Tuesday and Wednesday, registration

January 30 Wednesday, 11 a. m., opening convocation

January 31 Thursday, 8 a. m., class work in all divisions begins

February 22 Friday, Washington's Birthday, holiday

March 27 Wednesday, 4 p. m., to } Easter holidays

April 2 Tuesday, 8 a. m. }

May 27 Monday to } Final examinations

June 3 Monday }

June 2 Sunday, baccalaureate address

June 5 Wednesday, Commencement Day.

INFORMATION ABOUT THE UNIVERSITY

GENERAL STATEMENT

The fundamental aim of the University of Missouri is the development of the highest and most efficient type of citizen. For the purpose of attaining its aim, the University furnishes ample facilities for liberal education and for thorough professional training. The University is a part of the public educational system of the state.

ORGANIZATION

The work of the University is now carried on in the following divisions:

- College of Arts and Science
- College of Agriculture
- School of Education
- School of Law
- School of Medicine
- School of Engineering
- School of Mines and Metallurgy
- School of Journalism
- School of Commerce
- Graduate School
- Extension Division

All of these divisions are at Columbia, with the exception of the School of Mines and Metallurgy, which is located at Rolla. In addition, emphasis is given particular lines of work by the establishment of minor divisions, the chief of which are the Agricultural Experiment Station, the Engineering Experiment Station, and the Missouri State Military School.

LOCATION

The University of Missouri is located at Columbia, situated half way between St. Louis and Kansas City, near the center of the state. It is reached by the Wabash and by the Missouri, Kansas and Texas railways. Columbia is a progressive and prosperous town having doubled its population in the last few years.

Columbia may be characterized as a town of schools, homes, and churches, with enough of industrialism to make it efficient. It offers the convenience of a larger city without the counter attractions. The student is a predominant factor in Columbia.

EQUIPMENT

The University grounds cover more than 800 acres. The main divisions are in the west campus, the east campus, the athletic fields, and the University farm.

The following University buildings are located at Columbia: Academic Hall; Laws Observatory; separate buildings for chemistry, physics, biology, geology, engineering, manual arts, law, commerce; two power houses; Medical Laboratory Building; Parker Memorial Hospital; Agricultural Building; Horticultural Building; Schweitzer Hall for agricultural chemistry; green houses; Live Stock Judging, Poultry, Dairy, Farm Machinery, and Veterinary Buildings; the agricultural college farm barns and buildings; Switzler Hall for the School of Journalism; Gordon Hotel Building for home economics; Benton and Lathrop Halls, dormitories for men; Read Hall, dormitory for women; Rothwell Gymnasium; the houses for the President of the University and the Dean of the College of Agriculture; and High School and the Elementary School buildings, used for practice schools in the School of Education. The new library building, containing the General Library and the State Historical Library, affords also commodious seminary rooms for the use of students in the graduate courses.

FOR FURTHER INFORMATION

For further information in regard to the Graduate School of the University, address

DEAN OF THE GRADUATE FACULTY,

UNIVERSITY OF MISSOURI,
COLUMBIA, MISSOURI.

Full information regarding the University is given in the catalogue, which will be sent on request without charge. For this or special bulletins of the College of Arts and Science, College of Agriculture, School of Education, School of Law, School of Medicine, School of Engineering, School of Journalism, School of Commerce, Extension Division, and the Graduate School, write to

THE REGISTRAR,
UNIVERSITY OF MISSOURI,
COLUMBIA, MISSOURI.

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1918 NO. 1

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ANNOUNCEMENT 1918-19



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JANUARY, 1918

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Announcement of the Graduate School

GENERAL STATEMENT

Admission: Graduates of the colleges and universities comprising the Missouri College Union and of other reputable colleges and universities are admitted to the Graduate School. Admission to this school, however, shall not be understood as implying admission to candidacy for advanced degrees, which is subject to the regulations indicated below. Students are admitted to the Graduate School by the Registrar of the University to whom applications for admission should be addressed.

Fees and Expenses: Students are required to pay a library, hospital, and incidental fee of \$12 a semester. Those who file their study cards after the close of the last day of registration will be required to pay an additional fee of \$5 for late registration. Students taking laboratory work must make small laboratory deposits. The estimated cost of room rent and board for students living in Lathrop Hall, the dormitory for men, varies, according to the room, from \$3.50 to \$4.50 a week. In Read Hall, the dormitory for women, it varies, according to the room, from \$5.75 to \$6.25 a week. The total necessary expenses of a student living in the dormitory for men need not exceed \$250 a year; in the dormitories for women they need not exceed \$350. The necessary expenses for students living in private families vary from \$4 to \$6 a week.

University Fellowships and Scholarships: The University offers annually a limited number of University Fellowships yielding each a stipend of \$400 a year. These fellowships will be awarded, according as the applicants, irrespective of department, have demonstrated their ability to render service in the form of research. The University offers also a limited number of scholarships bearing stipends of \$200 annually, open to graduate students of high promise in scholarship, irrespective of the lines of work they may desire to pursue. It is expected that scholars will be well qualified to do graduate work in the subjects which they elect and that they will devote themselves mainly to work in these subjects. They will be called upon to render a limited amount of service to the University. University fellows and scholars are allowed to engage in outside work only with the consent of the Dean of the Graduate Faculty and the professor of the subject which they elect. The Executive Board, upon the recommendation of the dean and professor, may deprive any student of his fellowship or scholarship, whenever it may appear that he is not devoting himself as he should to his work as fellow or scholar. Applications must be filed not later than March 1, in order to receive considera-

UNIVERSITY OF MISSOURI BULLETIN

tion in the award for the following academic year. Applications received after this date and not later than June 1 will be considered in filing any vacancies that may occur in the fellowships or scholarships. Application blanks may be obtained from the Registrar of the University and when filled out should be sent to the Dean of the Graduate Faculty, Columbia, Missouri.

Gregory Fellowships and Scholarships: By the terms of the will of the late Charles R. Gregory of St. Louis, Missouri, the residue of his estate, amounting to approximately \$225,000, after providing for numerous bequests to charitable institutions, was left to the University of Missouri at Columbia to establish "The William Alexander Gregory Educational Fund." This must be invested by the Board of Curators "in a safe and prudent manner, the income from which shall be used in assisting white students of either sex in obtaining an education in any of the courses in said institution."

The Board of Curators has seen fit to provide that not more than \$1500 annually from this income may be used for the establishment and maintenance of fellowships and scholarships in the Graduate School to be known as the "Gregory Fellowships and Scholarships." These are awarded on the same conditions as the University fellowships and scholarships.

Peabody Fellowship in Education: In June, 1912, the trustees of the Peabody Education Fund gave the University the sum of \$6,000 on condition that it be held and used as an endowment of a Peabody Graduate Fellowship in education. The annual income from this fund will be paid to the holder of the fellowship.

Curators' Scholarships: By order of the Board of Curators, the student who attains the highest grade, or who shall be first in merit, in taking a bachelor's degree, in the graduating class of any of the colleges or universities composing the Missouri College Union will be admitted to this University for the first year without the payment of tuition, library, hospital, and incidental fees.

Agricultural Research Fellowships and Scholarships: The University offers annually a limited number of research fellowships in the Agricultural Experiment Station, each of the value of \$400, and scholarships, each of the value of \$200. It is the purpose of these fellowships and scholarships to foster and encourage original investigation and to give opportunity to students who desire to become efficient investigators in the field of agricultural science. All candidates for these fellowships and scholarships must fulfil the requirements for admission to the Graduate School of this University. (See page 3.)

These fellowships and scholarships are available in the departments of agricultural chemistry, animal husbandry, dairy husbandry, horticulture, botany, entomology, farm crops, and soils. They will be awarded to the candidates who are best prepared and are of the highest promise in scholarship. Application blanks for these fellowships may be obtained from the Director of the Agricultural Experiment Station, Colum-

bia, Missouri. Applications must be filed not later than March 1, in order to receive consideration in the award for the next academic year. Applications received after this date will be considered in filling any vacancies that may occur in these fellowships or scholarships.

United States Department of Agriculture Research Fellowship in the Improvement of Cereal Crops: The Bureau of Plant Industry of the United States Department of Agriculture has recently provided for a fellowship in cereal crops in the University of Missouri, bearing an annual stipend of \$400. This is the only fellowship of the kind offered in the United States. It is to be awarded to a graduate student in the University who has received special training for such investigations.

The purpose of these investigations shall be (a) to improve the cereal crops of the Central Mississippi Valley region as regards yield, quality, disease resistance, earliness, stiffness of straw, winter-hardiness, etc.; (b) to determine the best methods of cereal production; and (c) to study the fundamental laws of breeding and inheritance in cereals.

Literary and Scientific Societies: A large number of literary and scientific societies is maintained in the University, with practically each department and each special field of interest represented. Some of these are conducted by members of the faculty and are open to advanced students. Others are conducted by students, in some cases with the participation of members of the faculty.

Honorary Societies: There is a number of honorary societies in the University, organized for the purpose of raising scholastic and cultural standards in their respective lines. In addition to the general literary society, Phi Beta Kappa, the scientific society, Sigma Xi, the social science society, Alpha Zeta Pi, the national musical fraternity, Phi Mu Alpha, and general honor societies, there are similar organizations in the schools of Law, Engineering, Medicine, Journalism, Education, Business and Public Administration, the Graduate School, the College of Agriculture, and in several of the departments.

Publications: The "University of Missouri Studies," several series in "The University of Missouri Bulletin," and the "Publications of the Agricultural Experiment Station" are maintained as a means of publishing the results of original research in the University by instructors and graduate students.

University Libraries, Laboratories, and Museums: **LIBRARIES.** The University libraries comprise the general library and many departmental libraries. They contain about 200,000 volumes and pamphlets. Students have access also to the library of the State Historical Society of some 65,000 volumes and pamphlets.

LABORATORIES. Facilities for research in the sciences are provided in the following laboratories: animal husbandry, anatomy, astronomy, bacteriology, botany, chemistry, agricultural chemistry, dairy husbandry, engineering (civil, electrical, sanitary, and mechanical), entomology, experimental psychology, educational psychology, farm crops, geology and min-

erology, home economics, horticulture, pathology, pharmacology, physics, physiology, physiological chemistry, soils, veterinary science, and zoology.

MUSEUMS. There are also museums of art, classical archæology, ethnology, geology, and other collections.

Regulations Governing the Degree of Master of Arts: The degree of Master of Arts is offered to students who have spent at least one year exclusively devoted to advanced courses of study, and who have submitted an acceptable dissertation and passed all prescribed examinations.

A student wishing to make application for this degree must fill out a blank form, provided for the purpose, and must present it to the Dean of the Graduate Faculty on or before October 15.

In order to be accepted as a candidate for the degree, the student must give evidence that he has completed an undergraduate course of study such as is offered by colleges of good standing and that he has received a baccalaureate degree equivalent to the baccalaureate degree of the University of Missouri.

In making application the student must indicate the subject of the dissertation and the course of study selected by him on the form referred to above, which must bear the signature of approval of the professor in charge of his major subject, before it is presented to the dean for final action. He may, however, defer submitting the subject of the dissertation to the dean until November 1.

The candidate must choose a major subject, to which he must devote the greater part of his time during the year, and also such other subjects as may be approved. A majority of all work represented in the course of study must be selected from the courses strictly graduate in character.

A dissertation evincing capacity for original research and independent thought in the subject of the major work must be submitted to the Graduate Faculty for approval on or before April 1. The student should consult the Dean of the Graduate Faculty for information regarding the form in which the dissertation must be presented.

Each candidate for the degree of Master of Arts shall be required to pass final examinations, but the Graduate Faculty, upon the recommendation of the faculty of the department in which the candidate is taking his major work, may excuse the candidate from the requirement of a dissertation.

The attention of students is called to the fact that graduate work cannot be subjected to rigid regulation, and the Graduate Faculty reserves the right to deal with each case on its individual merits.

With the approval of the professors concerned, such candidates as have fulfilled all requirements may, at the close of the year, be recommended by the Graduate Faculty for the degree of Master of Arts.

Regulations Governing the Degree of Doctor of Philosophy:

1. **GENERAL STATEMENT.** The degree of Doctor of Philosophy is offered to students who have pursued advanced courses of study, without serious

interruption, for a period of at least three years, and who have submitted an acceptable dissertation and passed all prescribed examinations.

In order to be accepted by the Graduate Faculty as a candidate for the degree of Doctor of Philosophy, the student must give evidence that he has completed an undergraduate course of study such as is offered by colleges of good standing and that he has received a baccalaureate degree equivalent to the baccalaureate degree of the University of Missouri.

The faculty reserves the right to decide in each case whether the antecedent training has been satisfactory, and, if any of the years of advanced work have been passed away from this University, whether they may be properly regarded as spent in university studies under suitable guidance and favorable conditions. Private study or study pursued at a distance from libraries and laboratories will not be considered as equivalent to university work. In any case, the student must spend the year immediately preceding his final examinations in residence at the University of Missouri.

It should be emphasized that the requirements for this degree are not computed in terms of time and courses, but that the degree is conferred only upon such students as have reached, after long study, a high attainment in some special branch of learning and have given the clearest evidence of their ability to carry on independent, original research by reason of having made an actual contribution to knowledge of a character approved by competent judges.

2. ACCEPTANCE OF CANDIDATES. A student wishing to make application for the degree of Doctor of Philosophy must fill out a blank form, provided for the purpose, secure thereto the signature of the instructor with whom he desires to take his major subject and present it to the Dean of the Graduate Faculty for approval on or before October 15. He must also give satisfactory evidence of ability to translate French and German readily at sight.

3. REQUIREMENTS FOR THE DEGREE. (a) Subjects of Study.—Every candidate for the degree must select one principal or major subject and at least one and not more than two subordinate or minor subjects, the combination to be approved by the Graduate Faculty. The instructor with whom the student is taking his major subject acts as his official adviser and has the general direction of his work.

The student's principal work must be in the major subject. Although no regulations are laid down with respect to the time to be devoted to the major and minor subjects, in general it may be stated that the major subject should represent two-thirds of the student's entire time.

(b) Dissertation.—The dissertation, embodying the results of original investigation, must be written upon a subject approved by the adviser and must be submitted in typewritten form on or before April 1, when it becomes the property of the University. The student should consult the Dean of the Graduate Faculty for information regarding the form in which the dissertation must be presented.

Upon receiving the dissertation a committee is appointed whose duty it is to report upon it in writing to the Graduate Faculty.

The candidate is required to print or publish the dissertation, with such revision as the faculty may allow, and he shall present 150 copies of the work to the library of the University. The candidate is required to deposit \$50 to insure the publication of the dissertation within one year after the conferring of the degree. A brief biographical sketch of the writer must be appended to the dissertation.

(c) **Examinations.**—A committee, consisting of the professor of the candidate's major subject and the professors of his minor subjects, is appointed to take charge of all examinations and to report upon the same to the Graduate Faculty in writing.

In addition to final written examinations the candidate may be required to take an oral examination in the presence of the faculty.

(d) **Conferring of Degree.**—Upon the satisfactory completion of all requirements, the candidate may be recommended by the Graduate Faculty for the degree of Doctor of Philosophy.

COURSES OF INSTRUCTION

Courses preceded by a number with the letter a attached, thus: 104a, 106a, are given the first semester only. Those preceded by a number with the letter b attached, thus: 104b, 106b, are given the second semester only. Those preceded merely by a number are continuous courses and are given both semesters. The number of hours' credit given for a course for each semester is indicated by the Arabic numerals following the statement of the course. Courses numbered 200 and above are strictly graduate in character.

GROUP OF CLASSICAL LANGUAGES

CLASSICAL ARCHAEOLOGY

106. **History of Greek Art.** A preliminary study of Assyrian and Egyptian art, followed by a study of the development of Greek architecture and sculpture. Lectures, collateral reading, essays, with constant use of the lantern, photographic reproductions, and models and casts in the Museum of Classical Archæology. Ancient history is recommended to the students of this course. (3) MR. PICKARD.

107a. **Mycenaean Art or Art of Primitive Greece.** The earliest discoveries at Mycenae, Tiryns, and elsewhere will not be neglected, but special attention will be given to the most recent publications on Troy, Crete, and the Argive Heraeum. (1) MR. PICKARD.

108b. **Introductory Study of Greek Vases and Vase Paintings.** (1) MR. PICKARD.

While a knowledge of the Greek language is not an absolute prerequisite for courses 107a and 108b, they are intended for advanced students in Greek.

109. **Etruscan and Graeco-Roman Art.** Should be preceded by course 106. It will deal with the earliest art of the Italian Peninsula, endeavor to show how this art reached its highest development among the Etruscans, how Etruscan influenced early Roman art, how later Roman art grew out of early Roman and late Greek art modified by the circumstances and character of the Romans. Ancient history is recommended to students in this course. (2) Mr. PICKARD.

110. **Roman Life.** A systematic study of the topography of Rome and of extant remains particularly of Rome and Pompeii. Lectures and readings. Illustrated by the use of plans, maps, and lantern slides. As supplementary to this course, Latin, course 103a and 104b, is recommended. (2) Mr. PICKARD.

214. **Topography and Monuments of Athens.** Frazer's Pausanias will be taken as the basis of discussion. A reading knowledge of Greek, French, and German is required. (2) Mr. PICKARD.

215. **Archaeological Seminary.** Hours and work to be arranged. Mr. PICKARD.

For courses in the history of art, see page 39.

GREEK

113a. **The Greek Theater.** The origin and development of the Greek theater will be considered and disputed points in the structure of the theater and in the presentation of plays will be discussed. The basis of the work will be Doerpfeld and Reisch's *Das Griechische Theater*. (1) Mr. MANLY.

114b. **Aristophanes.** Selected comedies will be read and the origin and development of comedy will be considered. Attention will also be given to the life of the people as revealed in the plays. (2) or (3) Mr. SCOGGIN.

216. **Hesiod and Homeric Hymns.** Students should provide themselves with *Hesiodi Carmina* ed. A. Rzach, Teubner, Leipzig, and *Hymni Homerici* ed. A. Baumeister, Teubner, Leipzig. (2) or (3) Mr. MANLY.

217. **Homer.** The whole of the Iliad and the Odyssey will be read during the year with especial attention to the antiquities. (2) or (3) Mr. MANLY.

221. **Seminary.** Mr. MANLY.

LATIN

101. **Latin Prose Composition.** Prerequisite, course 50. Advanced course. (1) Mr. WRIGHT.

103a. **Cicero's Letters.** Prerequisites, courses 30 and 70. Study of Roman public and private life through the reading of the correspondence of Cicero. (3) Mr. WRIGHT.

Students electing this course are advised to take with it course 106b in history.

104b. **Juvenal.** Prerequisites, courses 30 and 70. Study of Roman public and private life through the satires of Juvenal. (1) Mr. WRIGHT.

106. **Catullus and the Elegiac Poets.** Prerequisites, courses 30 and 70. Selected poems of Catullus, Tibullus, Propertius, and Ovid. (3) Mr. MILLER.

109a. **Latin Comedy.** Not given in 1918-19. Prerequisites, courses 30 and 70. Representative plays of Plautus and Terence. (3) Miss JOHNSTON.

112. **Tacitus: Agricola, and the Life of Nero from the Annals.** Prerequisites, courses 30 and 70. (3) Mr. WRIGHT.

115. **Rapid Reading.** Prerequisite, courses 103a and 104b or equivalent. History of Latin literature, with readings from authors representative of each period. (2) Miss JOHNSTON.

125b. **Lucretius.** Not given in 1918-19. Prerequisites, courses 30 and 70. (3) Miss JOHNSTON.

217. **Seminary.** To be arranged. (3) Mr. MILLER.

SANSKRIT AND COMPARATIVE PHILOLOGY

218a. **Historical Greek Grammar.** Phonology and morphology. The lectures will deal systematically with noun and verb inflection within the Greek language itself. The student should procure Brugmann's *Griechische Grammatik* and Solmsen's *Inscriptiones Graecae ad illustrandas dialectos selectae*. (3) Mr. SCOGGIN.

219b. **Historical Latin Grammar.** The sounds and inflections of the Latin language will be set forth briefly in lectures. The student should own Lindsay's *Latin Language* and the same author's *Latin Inscriptions*. (3) Mr. SCOGGIN.

220. **Elementary Sanskrit.** Elements of the language. Translation of Sanskrit into English and English into Sanskrit. Thorough drill in forms. Whitney's *Sanskrit Grammar*; Lanman's *Sanskrit Reader*; and Perry's *Primer*. (3) Mr. SCOGGIN.

GROUP OF MODERN LANGUAGES

ENGLISH

101a. **Advanced Composition.** Informal courses in practical composition open to a limited number of upperclassmen. (3) Mr. RANKIN.

106b. **Debating.** Investigation of special questions; practice in debate. Designed especially for members of the debating squad. (3) Mr. LEWIN.

107a and 108b. **Dramatic Interpretation.** A study of selected plays; a discussion of the problems of the public presentation of plays; the acting of plays. (2) Mr. DEWEY; Miss NARDIN; Mr. TISDEL.

109a and 110b. **Public Speaking.** The principles of public speaking, extemporaneous and formal; practice in writing and speaking. Mr. DEWEY; Mr. TISDEL.

113b. **English Versification.** A study of the technique of English verse, with practice in metrical composition. (2) Mr. LEWIN.

119. **The English Language.** The science of language; the present facts of the English language; the past development of English; an introduction to Old English. (3) Mr. RAMSAY.

125a. **Chaucer and His Time.** Not given in 1918-19. (3) Mr. RANKIN.

135a and 136b. **Shakespeare.** (a) Hamlet; (b) King Lear; Othello; Henry V; The Tempest. (3) Mr. FAIRCHILD.

155a. **Dryden and Pope.** The age of satire, politics, and philosophy in English verse. (3) Mr. BELDEN.

156b. **Swift and the Essayists.** The literature, especially in prose, of the reign of Queen Anne. (3) Mr. BELDEN.

161a. **The Novel.** The novel as a literary form, with special reference to the nineteenth century novel. (3) Mr. FAIRCHILD.

162b. **The Rise of English Prose Fiction.** The early forms of narrative in English; the development of the novel down to the opening of the nineteenth century. (3) Mr. FAIRCHILD.

165a. **The Romantic Period.** A comprehensive lecture and reading course. (3) Mr. TISDEL.

166b. **The Victorian Period.** A comprehensive lecture and reading course. (3) Mr. TISDEL.

171a and 172b. **Modern Prose Writers.** A study of the works of representative authors, with weekly reports and monthly essays. (3) Mr. RANKIN.

175a and 176b. **American Literature.** (a) Sectional development; (b) growth of nationality; (c) present tendencies. (3) Mr. BELDEN.

178b. **Recent and Current English Literature.** Representative writers and literary movements of the last twenty-five years. (3) Mr. RAMSAY.

108b. **The Foreign Debt of English Literature.** The purpose of the course is to give the student some acquaintance with the greater literary masterpieces of the world, and to indicate the nature and to some degree the extent of the influence which they have exerted upon English literature. (3) Mr. RANKIN.

210b. **Style and Usage.** Investigation of selected principles of English usage, structure, and style. (3) Mr. BELDEN.

219a. **Literary Criticism.** The history of critical theory, with reading of standard works; current theories and problems. (3) Mr. FAIRCHILD.

221. **Beowulf.** Not given in 1918-19. (3) Mr. BELDEN.

225b. **Middle English Literature.** Not given in 1918-19. (3) Mr. RANKIN.

226. **Seminary.** Chaucer. (3) Mr. RANKIN.

227a. **The Popular Ballad.** A study of popular poetry on the basis

of Child's English and Scottish Popular Ballads, with analysis of current theories, and illustrations from balladry in Missouri. (3) Mr. BELDEN.

233. **Historical Grammar.** The origin and development of the English language with investigation of special topics. (3) Mr. RAMSAY.

235. **Elizabethan Drama.** Not given in 1918-19. (3) Mr. FAIRCHILD.

239a. **Later Elizabethan Drama.** Not given in 1918-19. (3) Mr. RAMSAY.

245a and 246b. **Milton.** Not given in 1918-19. (3) Mr. FAIRCHILD.

265. **Wordsworth and Coleridge.** Not given in 1918-19. (3) Mr. TISDEL.

267. **Tennyson and Browning.** The investigation of special topics, historical and critical. (3) Mr. TISDEL.

277a. **The Modern Drama.** A comparative study of the modern European drama. (3) Mr. RAMSAY.

GERMANIC LANGUAGES

104a and 104b. **Masterpieces in Modern German Drama, Lyrics, and Novel.** Intensive study, from the literary and cultural side, of a number of carefully chosen Modern German dramas, lyric poems, and novels. Parallel reading and reports. (3) Mr. ALMSTEDT.

105a. **Outline Course in German Literature.** The aim of the course is to acquaint the student with the most important works and movements in the evolution of German literary life. (3) Mr. HOFFMAN.

106b. **Lessing.** Lectures on Lessing's life and works; intensive study of Lessing, the dramatist and the critic; essays written in German; course conducted in German. (3) Miss STEWART.

107a and 108b. **Schiller.** Lectures on Schiller's life and works; intensive study of Schiller's dramas and poetry; essays written in German; course conducted in German. (3) Mr. HOFFMAN.

109a and 110b. **Goethe.** Lectures on Goethe's life and works; intensive study of Goethe's poetry, and dramas; essays written in German; course conducted in German. (3) Mr. ALMSTEDT.

111b. **Outline Course in Historical Grammar.** This course, together with course 105a, is arranged to meet the needs of the prospective teacher in German. Though a knowledge of the older periods is desirable, it is not required. (3) Miss STEWART.

112b. **Advanced Composition and Conversation.** Advanced course in German theme-writing; discussions of grammatical, syntactical, and stylistic points. This course is intended for teachers of German or for students who propose to become teachers of German; conducted in German. (2) Mr. HOFFMAN.

113b. **Middle High German.** Introductory course. For advanced seniors. The class will study *Der Arme Heinrich* by Hartmann von Aue. Translation of medieval idiom into modern German. (3) Mr. ALMSTEDT.

114b. **German Drama of the Nineteenth Century.** An outline course in modern German political, social, and cultural movements, re-

flected in certain typical dramatists of this period. Lectures; parallel readings; reports. (3) Mr. NOLLE.

212. **German Literature of the Second Half of the 19th Century.** This course will consist of lectures and reports. During the first semester Hebbel, Ludwig, Freytag, and Wagner will be especially emphasized. The minor authors will be treated in lectures. The second semester will be devoted to a study of the realistic writers of Germany, especially Hauptmann, Sudermann, Wildenbruch, and Fulda. The foreign influence on these writers will be carefully considered. (3) Mr. HOFFMAN.

213b. **Romanticism.** This course is intended to comprise an exhaustive study, as far as is possible, of German romanticists and their works and to show the relation of this movement to similar ones in other literatures. (3) Mr. HOFFMAN.

214a. **The Reformation and Renaissance (1500-1750).** The aim of this course is to give the student a clear view of the development and decline of the literary tendencies, forms, and ideals of this period, and the influences that help to develop them or to accelerate their decline. (3) Mr. NOLLE.

215b. **Middle High German.** Walther von der Vogelweide. Discipline in phonology, morphology, syntax; comparison of medieval with modern idiom; a study in lyric poetry. (3) Mr. ALMSTEDT.

216a. **History of the Nibelungenlied.** This course comprises a study of the various theories as to the origin and authorship of the poem, the controversies in regard to it, and its relation to the Nibelungensaga and other sagas. A reading knowledge of Middle High German is required. (3) Mr. HOFFMAN.

217b. **Old High German.** Prerequisite, course 220a. Phonology and forms; critical reading of Old High German texts: Braune, *Althochdeutsche Grammatik* and *Althochdeutsches Lesebuch*. (3) Mr. ALMSTEDT.

218. **Old Norse.** Prerequisite, course 220a. Phonology and forms; critical reading of one or more sagas. Texts: Heusler, *Altislandisches Elementarbuch*; and Heusler, *Zwei Islander-Geschichten*. (2) Mr. ALMSTEDT.

219. **Old Saxon.** Phonology and forms; critical reading of the Heliand. A desirable antecedent, course 220a. (2) Mr. ALMSTEDT.

220a. **Gothic.** Phonology, morphology, and syntax; reading from Ulfilas; the relationship of Gothic to Indo-European and to later Germanic dialects; general introduction to the study of Germanic philology. (3) Mr. ALMSTEDT.

221. **Current Publications.** (1) Miss STEWART.

222a and 223b. **Seminary.** Subject to be determined. For special students only. (2)

Other courses in Germanic languages will be arranged if the needs of the students require.

ROMANCE LANGUAGES

FRENCH

101. **French Phonetics.** The organs of speech, sound formation, drill in French pronunciation. (1) Mr. MURRAY.

106. **Practical Exercises in French.** Prerequisite, course 3. In exceptional cases, others may be admitted with the consent of the instructor. Designed to give students facility and accuracy in writing and speaking French; brief review of grammar and syntax; correction of pronunciation; translation into French; explanation of texts; practice in narration; discussions of current events based on some French periodical. Conducted entirely in French. (2) Mr. SELBERT.

107. **French Drama of the Seventeenth Century.** Prerequisite, course 3. In exceptional cases, others may be admitted with the consent of the instructor. The development of the drama in the seventeenth century will be studied with special reference to the work of Corneille, Racine, and Moliere, whose most important plays will be carefully read. Lectures, assigned readings, reports. (2) Mr. HACKER.

110. **French Literature and Ideas of the Eighteenth Century.** Prerequisite, course 3. In exceptional cases, others may be admitted with the consent of the instructor. The intense intellectual activity of literary men of the eighteenth century; the influence of French literature on foreign literatures; Montesquieu, Voltaire, Rousseau, the Encyclopedists, etc. (3)

113a. **The Romantic Period.** Prerequisite, course 3. Others may be admitted with the consent of the instructor. The innovations of the Romantic writers; their insistence on liberty and individualism; the new impetus to lyric poetry; the only modern epic; drama and melodrama; historical and idealistic novel; creation of modern criticism. Reading of important works of Victor Hugo, Lamartine, Musset, Vigny, Gautier, Dumas, Sand, etc. Lectures, discussions, reports. (3) Mr. SELBERT.

114b. **Balzac and the Beginnings of Naturalism.** Prerequisite, course 3. Others may be admitted with the consent of the instructor. The transition from Romanticism to Naturalism; development of the psychological and realistic novel; the moral drama; tendency toward impersonal expression in lyric poetry; history as an art. Study of important works of Balzac, Stendhal, Mérimée, Flaubert, Dumas *fils*, Augier, Gautier, Banville, Baudelaire, Taine, Sainte-Beuve. Lectures, discussions, reports. (3) Mr. SELBERT.

115. **Recent and Current French Literature.** Prerequisite, course 3. In exceptional cases, others may be admitted with the consent of the instructor. Study of modern works from the point of view that some of them may become classics; sociological tendencies in the modern novel and drama; symbolists and decadents; the regionalistic movement in the novel; literary criticism as art or science; reading of significant works

of Bazin Barrès, Bourget, Brioux, Brunetière, Anatole France, Loti, Maeterlinck, Lemaître, Régnier, Richopin, Rostand, Verhaeren, etc. Lectures, conferences, reports. (3) Mr. MURRAY.

116. **The Literature of the Sixteenth Century.** Not given in 1918-19. Prerequisite, any of the following courses: 107, 110, 113a, 114b, 115. In exceptional cases, others may be admitted with the consent of the instructor. The first decisive steps in French literary art; Rabelais, as a sociological observer; Montaigne, the philosopher and stylist; Ronsard and the Pléiade, as the ancestors of the Romantic School of the nineteenth century; the beginnings of the drama. (2) Mr. WARSHAW.

118. **Early French Writers.** Prerequisite, any of the following courses: 107, 110, 113a, 114b, 115, 116. The most important authors preceding the Renaissance; the development of the drama: mysteries and miracle plays, farces, sotties, and moralités; the historians; moral writers; the lyric poets. (2) Mr. SELBERT.

212. **Seminary in French Literature.** Detailed study of some literary movement or representative writer. (2), (3) or (4) Mr. MURRAY.

214. **General Introduction to Romance Philology.** 2) Mr. MURRAY.

215. **Old French.** Prerequisite, course 214. (2) Mr. MURRAY.

216. **Seminary in Romance Philology.** Provençal, Old Spanish, Old Italian. (2) Mr. MURRAY; Mr. WARSAW.

ITALIAN

121. **Reading, Composition, and Conversation.** Prerequisite, course 20. Conducted entirely in Italian. (2) Mr. —

125. **Dante.** The *Divina Commedia*. Not given in 1918-19. (2) Mr. —

SPANISH

136. **The Spanish-American Novel.** Prerequisite, course 31 or its equivalent. The rapid reading of representative works accompanied by constant exercise in composition and conversation. (2) Mr. WARSAW.

237. **Seminary in Spanish Literature.** Individual work in some phase of Spanish or Latin-American literature. (2), (3), or (4) Mr. WARSAW.

Spanish Philology. See courses 214 and 216.

GROUP OF PHILOSOPHY AND EXPERIMENTAL PSYCHOLOGY

EXPERIMENTAL PSYCHOLOGY

These courses are open only to students who have had an introductory course in general psychology.

102a and 112b. **Experimental Problems.** (1), (2), or (3) Mr. MEYER.

108a or b. **Abnormal Psychology.** The abnormalities of mental life resulting from inborn, pathological, or artificial causes (such as idiocy, aphasia, apraxia, somnambulism, hypnosis, etc.) and their educational, medical, and forensic significance. (3) Mr. MEYER.

203a or b. **Graphology.** The manifestation of individual characteristics in peculiarities of script. Methods of identifying individual handwriting and of discovering forgeries. A reading knowledge of either French or German is required. (2) Mr. MEYER.

205a or b. **Theory of Music.** The aesthetic laws of music. The psychological differences between primitive and highly developed music and between European and exotic music. (2) Mr. MEYER.

206a or b. **Principles of Psychology.** Discussion of the general principles of scientific investigation. Application of these principles in the criticism of modern psychological theories and problems. (3) Mr. MEYER.

209a or b. **Psychological Systems.** A comparative study of the psychological systems as found in the chief text-books on psychology issued during the last thirty years. (4) Mr. MEYER.

PHILOSOPHY

103a. **Ethical Theory.** Prerequisite, sophomore standing. An introductory study of the main problems of ethics and of the chief methods of their solution, with constant reference to the principal historic schools for illustration and interpretation. The following topics will be included: the nature of ethics as a philosophical discipline; hedonism; intuitionism; utilitarianism; self-realization; the ground of obligation; conscience; freedom; egoism and altruism; optimism and pessimism. (3) Mr. HUDSON.

104a. **History of Ancient and Medieval Philosophy from the Ionian Schools to Bacon.** Prerequisite, sophomore standing. Including a careful reading of the greater part of Plato's *Republic*. (3) Mr. HUDSON.

104b. **History of Modern Philosophy from the Renaissance to the 19th Century.** Prerequisite, sophomore standing. Properly follows course 104a, though this is not required. The development of modern systems and their relations to science and to political and social movements. (3) Mr. SABINE.

108a. **Philosophical Applications of Evolution.** Not given in 1918-19. Prerequisite, sophomore standing. The origin of the theory of evolution, its application outside biology, particularly in ethical theory, and its meaning and value for metaphysics. (2) Mr. SABINE.

109a. **Philosophy in the Life of the Nineteenth Century.** Prerequisite, sophomore standing. A non-technical presentation of philosophical ideas which have played a part especially in social and political movements of the nineteenth century. Mr. SABINE.

111b. **Philosophy of the State.** Prerequisite, junior standing. An historical and critical survey of theories of political obligation and political liberty. (3) Mr. SABINE.

112b. **American Ideals.** Prerequisite, junior standing. A study of the metaphysical and ethical interpretations of life implied in American social and political institutions. (3) Mr. HUDSON.

121b. **Contemporary Metaphysics.** Prerequisite, course 104b or an equivalent. Representative systems, issues, and controversies of the present day; general relations to historic philosophy. Stress is laid upon the problems and tendencies characteristically modern in their setting, such as those aroused by the development of modern science. (3) Mr. HUDSON.

122a. **Scientific Naturalism.** Prerequisite, course 104b or an equivalent. Materialism and other types of metaphysics that profess to depend in a special sense on the natural sciences; reading of Haeckel, Spencer, and others. (3) Mr. SABINE.

230a and 230b. **Seminary.** Subject to be determined. Two or three hours' credit according to the amount of work done. Mr. HUDSON; Mr. SABINE.

GROUP OF EDUCATION

102a and b. **Educational Psychology.** Prerequisite, Experimental Psychology 1a or b, or 10a or b. An introduction to the science of education. An application of the methods and results of experimental psychology to the problem of training children. (3) Mr. PYLE.

110a and b. **The Psychology of Learning.** Prerequisites, an approved course in general psychology, and course 102a or its equivalent. Undertakes to work out a science of education based upon a knowledge of the child and the laws of learning. A part of the course will consist in a study of the period of adolescence. 110a, lectures, textbook and laboratory; 110b, laboratory only. (Credit to be arranged.) Mr. PYLE.

111b. **Psychological Tests.** A laboratory course in mental and physical tests, the psychology of individual differences, and the economy and technique of learning. (3) Mr. PYLE.

112a. **Abnormal and Defective Children.** A study of subnormal and supernormal children from the standpoint of genetic psychology. Examination of the causes of these deviations, tests for their determination, and a study of their proper treatment. (1) Mr. PYLE.

113a and 114b. **Current Problems.** A study of current problems in education from the point of view of psychology. Informal discussions and reports of periodical literature in educational psychology. May be elected in successive years. (1) Mr. PYLE.

120. **History of Education.** (2) Mr. COURSAULT.

121a. **Educational Classics.** An intensive study of the historical setting and content of a few educational classics which mark prominent

movements in the development of educational thought and practice. (3) Mr. COURSAULT.

130a and b. **Theory and Observation of Teaching.** A study of methods of class work with illustrations and observations in all grades of public school work. (3) Mr. MERIAM; Mr. WATKINS.

(Unless otherwise specified below, courses 131-148, inclusive, deal with the teaching and administration of these courses in high schools. Lectures, discussions, references.)

131b. **Teaching of Art.** (2) Mr. ANKENY.

132b. **Teaching of Botany.** (2) Mr. DURAND.

133a or 133 b. **Teaching of Chemistry.** (2) Mr. SCHLUNDT.

124b. **Teaching of English.** (2) Mr. BELDEN; Mr. FAIRCHILD; Mr. DEWEY.

135b. **Teaching of Geography.** Prerequisite, course 1a or 1b, or 6, or equivalent preparation. (2)

136b. **Teaching of German.** (2) Mr. ALMSTEDT.

137b. **Teaching of History.** (2) Mr. TRENHOLME.

138b. **Teaching of Home Economics.** (2) Miss STANLEY.

139b. **Teaching of Latin.** (2) Mr. MILLER.

140b. **Teaching of Manual Arts.** Lectures and discussions on the aims and methods of teaching manual training in the high schools and elementary schools. (2) Mr. GRIFFITH.

141b. **Teaching of Mathematics.** (2) Mr. AMES.

143b. **Teaching of Physical Education.** Especially designed for kindergartens, grade schools, high schools, and playgrounds. (2) Miss STEWART.

144b. **Teaching of Physics.** (2) Mr. STEWART.

145b. **Teaching of Physiology.** Methods and materials for elementary and high schools. Lectures and demonstration on the selection and utilization of materials and on methods of teaching physiology in the grades and in the high schools. (2) Mr. GREENE.

146b. **Teaching of Zoology.** (2) Mr. CURTIS.

147b. **Teaching of Spanish.** (2) Mr. WARSAW.

148b. **Teaching of Education.** This course deals with the problems of teacher-training work in the high school. (2) Mr. —.

149. **Statistical Studies in Theory of Teaching.** The application of statistical methods to the testing and improvement of methods of teaching. (3) Mr. —.

150a. **School Supervision.** Arranged for superintendents, principals, and supervisors. Laboratory work in the University schools. (2) or (3) Mr. MERIAM.

150b. **Supervision of Instruction.** Principles and practice of class criticism, arranged for superintendents, principals, and supervisors in public schools and normal schools. Laboratory work is provided in the University schools. (2) or (3) Mr. MERIAM.

151. **Elementary Education.** Planned for those preparing for special work in teaching or supervising in elementary schools, and including much observation and laboratory work in the University Elementary School. (3) Mr. MERIAM.

160b. **School Economy.** Effective methods of school management from the standpoint of the teacher in secondary schools. (2) Mr. ELLIFF.

161b. **School Administration.** The third hour of credit given for individual practice work in investigation and solution of practical problems involved in the administration of the University High School and Columbia public schools. Twice a week. (2) or (3) Mr. ELLIFF.

163b. **High School Administration.** Prerequisites, courses 102a and 120 or equivalent. (3) Mr. ELLIFF.

164a. **Administration of Art Education.** Intended to acquaint superintendents and supervisors with the working details of art education from the administrative standpoint. No previous credit in art a prerequisite. (1) Mr. ANKENY.

165a. **Organization and Administration of Manual Arts.** Development of manual arts in the United States; the organization of work in different grades; courses of study; supplies; plans and cost of equipment in elementary and secondary schools; maintenance and problems of administration. (2) Mr. GRIFFITH.

166b. **Administration of Agricultural Education.** A discussion of modern movements and methods in agricultural education. Credit in agriculture not a prerequisite. (1) Mr. MUMFORD.

170b. **Principles of Education.** (3) Mr. COURSAULT.

180a or b. **Practice Teaching.** Hours and credits must be arranged with instructor before registration. Application should be made the semester preceding that in which the course is wanted. Students taking this course must reserve the class hour Th. 3 for teachers' meetings. Hours of credit to be arranged. Mr. MERIAM; Mr. WATKINS; Miss SEARCY.

190a. **School Hygiene.** (1) Mr. RAVENEL.

210. **Seminary in Educational Psychology.** Open only to students who have had considerable training in both education and psychology. For thesis work. Credit to be arranged. Mr. PYLE.

221. **Research in Educational Psychology.** Open only to students who have had considerable training in both general and educational psychology, including training in psychological method. Original investigation of problems in any field of educational psychology. Credit to be arranged. Mr. PYLE.

220. **Seminary in History of Education.** Thesis work for graduate degrees. Mr. COURSAULT.

221b. **History of Education in the United States.** Research course for advanced students. (2) Mr. COURSAULT.

232. **Problems in the Teaching of Art in Secondary Schools and Colleges.** Opportunity will be given the student to conduct original investigation. (2) or (5) Mr. ANKENY.

250. **Seminary in School Supervision and Theory of Teaching** Problems and thesis work for graduate degrees. Opportunity is offered for experimental work in the University schools. Mr. MERIAM.

251. **Public School Curriculum.** Research work in courses of study for elementary schools and for high schools. Statistical studies of results of school work are included. (3) Mr. MERIAM.

260b. **Seminary in School Administration.** Prerequisite, course 161b or 163b. May be taken in connection with thesis work for graduate degree. Credit to be arranged. Mr. ELLIFF.

270. **Seminary in Philosophy of Education.** Thesis work for graduate degrees. Mr. COURSAULT.

271. **Philosophy of Education.** A study of the fundamentals of education in the light of modern science and philosophy. (3) Mr. COURSAULT.

GROUP OF HISTORY AND POLITICAL SCIENCE

ECONOMICS

105a and b. **Money, Credit and Banking.** A study of the relation of the production of the precious metals and the banking business to the supply of money and the price of commodities. (5) Mr. BROWN.

106a. **Transportation.** The theory of rate making, competition of transportation lines, transportation monopoly, discriminations and their effects, and rate regulation. Particular attention is devoted to leading decisions of the Interstate Commerce Commission. (2) Mr. BROWN.

107a. **Economic History of the United States.** Influence of economic factors in the development of the United States. (3) Mr. WOOSTER.

108b. **Financial History of the United States.** The origin and development of the currency, banking, and revenue systems of the United States. (3) Mr. WOOSTER.

110a. **Labor Problems.** A critical study of labor conditions and of the various means of improving them. (5) Mr. WOOSTER.

115b. **Public Revenues.** A study of the finances and financial methods of governments, with special reference to taxation. (5) Mr. ROGERS.

117b. **Advanced Accounting.** An intensive study of the balance sheet and income statement: a detailed study of cost accounts and of special problems in partnership, corporate, and estate accounting. (4) Mr. SCOTT.

118a. **Corporation Finance.** Describes the purposes and methods pursued in the organization and management of business corporations and

the uses and character of corporation securities as related to the investors and to the corporation's management. (3) Mr. ROGERS.

119b. **Trusts and Combinations.** The development of business organizations, the financing of such enterprises, their relations to the control of industry, the prices of commodities, and the distribution of wealth. (2) Mr. ROGERS.

120a. **Speculative Markets and Business Cycles.** The organization, methods, and functions of produce exchanges and securities markets and the influence of their operations upon the movements of prices. The recurring periods of activity and inactivity in business known as prosperity, crisis, and depression, and their relation to speculative and investment transactions. (3) Mr. ROGERS.

121a. **Accounting and Business Policy.** A comparative study and interpretation of accounting methods: an examination of the relations of accounting to business policies. (2) Mr. SCOTT.

122a. **Investments.** A study of the forms of investments—stocks, bonds and mortgages—in regard to their suitability for the different types of investors. (2) Mr. ROGERS.

124b. **Foreign Exchange and Trade.** (a) the principles and practice of foreign exchange; (b) analysis of principles underlying foreign trade; (c) shipping, finance, and sales problems. (2) Mr. BROWN.

134a. **Public Accounting and Auditing.** The organization of accounts, state, county, and municipal; accounts of public service corporations under both public and private operation. (2) Mr. SCOTT.

136b. **Employment Problems.** A critical study of methods and systems of hiring and handling employees in various lines of industry. Problems of employment and organization are studied from the employer's point of view. (2) Mr. WOOSTER.

138a or b. **Mercantile Organization.** Given in alternate years. Not given in 1918-19. An analytical study of wholesale and retail merchandising. Special types of organization, such as the manufacturing jobber, the mail order house, the chain store, and the department store, are analyzed critically from the viewpoint both of the business man and the public; and various price systems and selling policies are similarly examined. (2) or (3).

211b. **Advanced Economic Theory.** A critical examination of the writings of the leading economists from the time of Adam Smith to the present, to the end of constructing a correct theory of value and distribution. A survey of the theoretical aspects of the science. (5) Mr. VEBLEN.

212a and 213b. **Seminaries.** Credit to be arranged. Mr. VEBLEN; Mr. BROWN; Mr. WOOSTER; Mr. ROGERS.

214a. **History of Economics.** A first-hand study of authors and documents, with especial reference to the background of political and industrial conditions and of philosophical thought. The student is advised

to correlate this course with related courses in philosophy, political science, history, and sociology. (5) Mr. VEBLEN.

218a and 219b. **Economic Factors in Civilization.** An inquiry into institutions as affected by economic conditions with a view particularly to early European civilization. (2) to (5) Mr. VEBLEN.

HISTORY

105a. **Greek History.** (3) Mr. WRENCH.

106b. **Roman History.** Not given in 1918-19. Mr. WRENCH.

110a. **The Renaissance.** Cultural History, 1300-1500. Not given in 1918-19. Mr. TRENHOLME.

112a. **Economic and Social History of Medieval Europe.** 300-1500. Not given in 1918-19. (2) Mr. WRENCH.

113b. **Economic and Social History of Modern Europe.** 1500 to present. Not given in 1918-19. (2) Mr. KERNER.

115b. **Recent European History.** 1815 to present. (5) Mr. KERNER.

117a. **English History.** To 1485. (3) Mr. TRENHOLME.

118b. **English History.** 1485-1688. (3) Mr. TRENHOLME.

131b. **Oriental History.** 600 A. D. to present. Not given in 1918-19. (3) Mr. WRENCH.

150b. **European Culture and Civilization.** The Middle Ages. (2) Mr. WRENCH.

160a. **French Revolution and Napoleonic Era.** Not given in 1918-19. (3) Mr. KERNER.

163a. **Modern Germany and Austria-Hungary.** Not given in 1918-19. (2) Mr. KERNER.

165b. **Modern Russia.** (3) Mr. KERNER.

169a. **Recent European Diplomatic History and World Problems.** (2) Mr. KERNER.

175b. **English Constitutional History.** (2) Mr. TRENHOLME.

180a. **American Social History.** (3) Mr. STEPHENS.

182b. **History of the West.** (3) Mr. VILES.

184b. **History of the South.** Not given in 1918-19. (2) Mr. STEPHENS.

190b. **American Diplomatic History.** (3) Mr. STEPHENS.

195a. **Recent United States History.** 1877 to present. (3) Mr. VILES.

207a. **Recent English History.** Not given in 1918-19. (2) Mr. TRENHOLME.

210. **Seminary in Historical Research and Thesis Work.** (1), (2), (3), or (4). Mr. TRENHOLME, Mr. VILES, Mr. STEPHENS, Mr. WRENCH., Mr. KERNER.

286. **Seminary in Missouri History.** (3) Mr. VILES; Mr. STEPHENS.

POLITICAL SCIENCE AND PUBLIC LAW

104a. **European Governments.** A descriptive study of the constitutional organization and practical working of the principal governments of Europe, with considerable attention to political parties and current political questions. (5) Mr. SHEPARD.

105b. **Comparative Constitutional Law.** A comparative study of the legal and theoretical basis of the modern state, the various forms of government and the structure and function of the principal governmental organs. (3) Mr. SHEPARD.

106a. **Municipal Government.** A study of the organization of the cities of the United States. During the latter part of the course special topics will be taken up in more detail, such as: central control over cities, municipal elections, municipal revenue, the regulation of public utilities, and municipal ownership. (2) Mr. LOEB.

107a. **Party Government.** Not given, 1918-19. A study of the theory, organization, methods of action, and functions of political parties, with special emphasis on the party system of the United States. (2) Mr. BARCLAY.

108b. **State Administration.** Not given, 1918-19. A study of the development, organization, and functions of the executive branch of the American state governments, with special emphasis on the newer administrative agencies and the relation of the state government to contemporary economic and social problems. (2) Mr. SHEPARD.

109b. **International Law.** A general treatment of the law governing international relations in peace and war, with considerable attention to the problems arising out of the European war. (3) Mr. SHEPARD.

112a. **Federal Administration.** A study of public administration as practiced in the departments, commissions, and bureaus under the President. (2) Mr. BARCLAY.

120a. **Problems in Municipal Administration.** A detailed study of certain specific problems in the administration of cities. (2) Mr. BARCLAY.

201a. **Administrative Law.** Not given, 1918-19. A study of the legal principles regulating the acts of administrative officers of the national and commonwealth governments. (3)

204. **Constitutional Law of the United States.** Particular attention will be given to the field of individual liberty defined in the Constitution of the United States and interpreted in the decisions of the Supreme Court. (3) and (2).

210a. **History of Political Theories to the French Revolution.** A study of the development of political thought in its relation, as cause and effect, to political action, from the period of antiquity to the French Revolution. (2) Mr. SHEPARD.

211b. **Recent and Contemporary Political Theories.** A study of political theory since the French Revolution and its influences upon political action. (2) Mr. SHEPARD.

212a. **Proseminary.** Not given in 1918-19. (3) Mr. SHEPARD.

220a and 221b. **Seminary.** Credit to be arranged. Mr. LOEB; Mr. SHEPARD.

SOCIOLOGY

110a. **Social Pathology.** Prerequisite, course 1. A general course dealing with (1) the extent and causes of social maladjustment, with particular reference to poverty and pauperism; (2) methods of amelioration and fundamental social reforms; (3) the principles of relief in dependency cases; (4) charity organization and administration. (3) Mr. TAYLOR.

111b. **Criminology.** Prerequisite, course 1. The nature and causes of crime; the criminal and the juvenile delinquent; penal, reformatory, and preventive methods; the indeterminate sentence, probation, and parole; the reform of criminal procedure; police methods. (3) Mr. TAYLOR.

112a. **Preventive Philanthropy.** An intensive study of some specific problems in preventive work, including a study of child problems, playgrounds, child labor, and the juvenile court. Considerable time is given to the general problems of child welfare, especially those of normal child life. (2) Mr. TAYLOR.

115. **Rural Sociology.** A study of social conditions in rural life and their improvement. Among the topics considered will be the statistics and movements of rural population, the physical environment of rural life, isolation and means of communication, rural occupations, co-operative organizations among farmers, the family and woman's position in rural life, the country school, the country church, leadership, etc. Lectures, assigned reading, and papers. (2) Mr. TAYLOR.

116b. **Urban Sociology.** A study of social conditions in urban communities. The origin and growth of cities will be considered. An intensive study will be made of educational, political, moral, social, aesthetic, and religious forces and institutions in urban life. Municipal reform movements will be considered. Lectures, assigned reading, and papers. (2) Mr. TAYLOR.

125a. **General Anthropology.** A study of the origin and evolution of man as an animal and of the different races of mankind. The prehistoric human types, the principles of ethnology, and the characteristics of the Negro, Mongolian, American, and Caucasian races. Lectures and assigned reading. (3) Mr. ELLWOOD.

126b. **Cultural Anthropology.** A study of social origins and of the earliest stages in cultural evolution; the stone and metal ages, the origins of industry, language, magic, religion, morals, science, art, and of social organization in the family, horde, clan, and tribe. Lectures and assigned reading. (3) Mr. ELLWOOD.

220a. **The Principles of Sociology.** A critical study of sociological theory. The sociological theories of recent writers, such as Ward, Ross,

Giddings, and Hobhouse, will be critically examined with a view to laying the foundations for a constructive theory of the social life in modern biology and psychology. Discussions and papers by the class. (3) Mr. ELLWOOD.

221b. Biological Factors in Social Evolution. A course on the biological basis of sociology. Among the topics treated will be the relation of organic to social evolution with special attention to heredity, selection, adaptation, and variation, the beginnings of social evolution in the animal world, and the instinctive, emotional, and intellectual bases of association. Lectures, assigned reading, and research work. (2) Mr. ELLWOOD.

222b. Methods of Social Research. A study of methods of social investigation, including the Social Survey, the use of statistical methods, and other methods of social measurements. Concrete problems are assigned to each student for practice. (2) Mr. TAYLOR.

227a. The Negro in America. Not given in 1918-19. A study of the social, economic, moral, and educational conditions among the negroes of the United States. The work will consist of lectures, library work, and theses. Students will be admitted only after consultation. (2)

230b. History of Social Philosophy. Lectures on the development of social thought from Aristotle to the present. The social philosophies of Plato, Aristotle, St. Augustine, Thomas Aquinas, Machiavelli, Bodin, Hobbes, Locke, Vico, Montesquieu, Rousseau, Condorcet, and the sociological systems of Comte, Spencer, Shaeffle, Lilienfeldt, Gumplowicz, Ratzenhofer, and Ward will, among others, be considered. A large amount of assigned reading will be required in this course. The student is advised to correlate this course with related courses in economics, history, political science, and philosophy. (3) Mr. ELLWOOD.

231a. History of Philanthropy and the Poor Law. Not given in 1918-19. A study of the development of legislation governing and methods of administering public relief in England and America, and the parallel account of voluntary charitable institutions and methods. (2)

240. Seminary. Research work upon special problems in sociology and philanthropy. Two, three, or four hours' credit will be given, according to the amount of work. Mr. ELLWOOD; Mr. TAYLOR.

SCHOOL OF SOCIAL ECONOMY

A training School for Social Workers. Located in St. Louis.

101a. Problems of Poverty. This course deals with the causes of poverty and considers at length the individual and social factors involved. It includes a discussion of the remedial agencies, both public and private, and outlines their general sphere of effort. Special attention is given to the improvement of living and working conditions, and the development of better physical and mental types. (3) Mr. MANGOLD.

102a. Labor Problems. A review of the social effects of the industrial revolution and of the rise of the factory system. A study of labor

supply, wages, hours of labor, unemployment, labor organization, the sweating system, woman labor, minimum wage, standards and cost of living, workmen's compensation, factory inspection, and methods of promoting the amelioration of the wage-earning classes. (3) Mr. MANGOLD.

103. **Practice of Organized Charity.** During the first semester the course deals with the problems of the social reconstruction of individuals or families. The general principles and processes of social treatment are discussed and students are familiarized with the recognized methods of dealing with broken or depressed families. In the second semester a study is made of the methods of organizations specializing in particular case problems. This course provides the fundamentals for the practical training in case work. (3) Miss WILDER.

105b. **Neighborhood and Group Work.** A course designed to train students for effective work in handling groups in settlements, social centers, and in the welfare departments of stores and factories. The principles and methods underlying such work are studied and practical activities are required of the students. (3) Miss WILDER.

108b. **Crime and Its Treatment.** This course embraces a discussion of the physical and social causes of crime, the various schools of criminology, the police, the criminal courts, court procedure, jails, reformatories and penal systems, indeterminate sentence, adult probation, the cost of crime, and measures of prosecution. Special problems of the woman offender are considered. (2) Mr. MANGOLD.

109b. **Child Welfare.** This course begins with the study of heredity and environment as social factors. Then the problems of infant and child mortality, protection from disease, the playground movement, and the social aspects of education, including truancy, retardation, and industrial training are briefly discussed. Attention is given to child labor problems, juvenile delinquency, the probation system, reformatory institutions, measures of child protection, the dependent and neglected child, and child caring agencies, public and private. (3) Mr. MANGOLD.

111b. **Race Problems.** The course deals with the problems of immigration and discusses sources, social, economic, and political effects, methods of assimilation, immigration legislation, and effect on national character. A program of the work by public and private agencies to promote the Americanization of the immigrant is reviewed and a program of betterment is outlined. (3) Miss WILDER.

112b. **Race Problems.** A brief study is made of the negro, with special reference to St. Louis. The economic, social, and educational problems are considered. (1) Miss WILDER.

113a. **Social Activities of Cities.** The object of this course is to familiarize the student with those branches of municipal government that deal with the social problems of the city, to analyze their operations, to understand their scope and purpose, and to relate their activities to those of the private agencies in the community. Special attention is given to cities that have developed departments of social welfare. The effect and

value of improvements in governmental machinery are also discussed. (3) Mr. MANGOLD.

204. **Methods of Social Research.** A course dealing with the principles and practice of social investigations with practical work on a number of selected problems. The methods of inquiry used by state, federal, and private agencies are studied, and the value and validity of selected reports examined. Direct information is gained in regard to wages, cost of living, movement of population, birth rate, marriage and divorce, and other problems. (3) Mr. MANGOLD; Miss WILDER.

212b. **Organization and Function of Social Agencies.** A discussion of the functions and actual work of typical agencies such as charity organizations, anti-tuberculosis, children's aid, public health, and county welfare societies. Methods of co-operation through central council or federation, bases for a division of the field, problems of extension of service, and related questions are considered. (3) Mr. MANGOLD.

215. **Seminary.** Research course for special investigations and thesis work. (2-4) Mr. MANGOLD.

In addition to the above courses, practice work is required of every candidate for a degree.

GROUP OF MATHEMATICAL AND PHYSICAL SCIENCES

ASTRONOMY

102a. **Geodetic Astronomy.** Prerequisite, civil engineering, course 102. Determination of azimuth, time, latitude and longitude with the engineer's transit. (3) Mr. BAKER.

103b. **Practical Astronomy.** Prerequisite, course 1 or 102a and trigonometry. An introduction to the theory and use of astronomical instruments. Use of ephemerides. (3) Mr. BAKER.

105b. **Modern Astronomy.** Prerequisite, course 1. A study of the problems and aims of modern astronomical science; its relation to other sciences. Frequent references to current literature of astronomy. (3) Mr. BAKER.

106a or b. **Advanced Astronomy.** Prerequisite, course 102a, 103b, or 105b. Subjects are selected to meet the requirements of the individual students. Credit to be arranged. Mr. BAKER.

210b. **Stellar Photometry.** Theory and use of photometric apparatus. Investigation of stellar magnitudes and their variation, by visual and photographic methods. (3) Mr. BAKER.

220. **Research.** Opportunity for original investigation is offered to qualified students. Credit to be arranged.

CHEMISTRY

101a and b. **Advanced Inorganic Chemistry.** Prerequisites, courses 27a or b and 111. Lectures and recitations. (3) Mr. MARDEN.

102a and b. **Advanced Inorganic Chemistry.** An advanced laboratory course. May be taken with course 101a and b. (1), (2), or (3) Mr. MARDEN.

110a. **Organic Chemistry.** Prerequisite, ten hours' work in chemistry; medical students will be admitted to this course with eight hours chemistry. Required in the School of Medicine and in Chemical Engineering. (3) Mr. CALVERT; Miss DOVER; Mr. WALDRON.

111b. **Organic Chemistry.** Continuation of course 110a. Required in the School of Medicine and in Chemical Engineering. (3) Mr. CALVERT; Miss DOVER; Mr. WALDRON.

112a or b. **Preparation of Organic Compounds.** A laboratory course in synthetic organic chemistry. May be taken with courses 15a, 15b, and 111. According to amount of laboratory work done (2) or (3) Mr. CALVERT; Miss DOVER.

113a or b. **Preparation of Organic Compounds and Organic Analysis.** Laboratory course. According to amount of work elected (3), (4) or (5) Mr. CALVERT.

121. **Quantitative Chemical Analysis.** Prerequisite, course 27a or b. The general principles of gravimetric and volumetric analysis. A continuous course, but it may be begun in either semester. (3) Mr. BROWN; Mr. GIBSON.

122a. **Technical Analysis.** Prerequisite, course 121. Required of chemical engineers. Gas, water, and fuel analysis. (3) Mr. BROWN; Mr. GIBSON.

125a. **Quantitative Organic Analysis.** Must be preceded or accompanied by course 121. Quantitative analysis of commercial organic products, such as alcohols, aldehydes, organic acids, glycerine, oils and fats, carbohydrates, petroleum products, soaps. (3) Mr. CALVERT.

126b. **Quantitative Organic Analysis.** A continuation of course 125a. (3) Mr. CALVERT.

127a and b. **Advanced Qualitative Analysis.** Prerequisite, course 27a or b. The complete qualitative analysis of rocks, minerals, slags, and alloys. (2) Mr. GIBSON.

128a and b. **Advanced Qualitative Analysis.** Prerequisite, 127a or b. The qualitative detection of some of the less common elements and the qualitative analysis of inorganic commercial products. (2) Mr. GIBSON.

131a. **Physical Chemistry.** Prerequisite, a college course in physics, three hours of quantitative analysis, and three hours of organic chemistry. Stoichiometry of gases, liquids, and solids; solutions and the theory of ionization; thermochemistry; the phase rule; chemical equilibrium. (5) Mr. SILL.

133b. **Electrochemistry.** Prerequisites, same as 131a. Electrochemical measurements; electrolytic preparations; electrode potential and theory of electromotive force; technical electrolytic processes. (5) Mr. SILL.

135a or b. **Radioactivity.** Prerequisites, undergraduate courses in physics and chemistry. Radioactive types of matter and atomic disintegration. An introductory course. (3) Mr. SCHLUNDT.

141a. **Industrial Chemistry.** Prerequisites, courses 27a or b and 111. Application of chemistry to the purposes of human life, as illustrated in the more important arts and industries having a chemical basis for their principal operations and processes. Fuels, water, acids, fertilizers, cements, glass, pottery, paints, gas, explosives, metals, alloys. (3), (4), or (5) Mr. BROWN.

142b. **Industrial Chemistry.** Prerequisites, same as for course 141a. Starch, glucose, sugar, fats, soaps, dyes, and other industries. (2) or (3) Mr. BROWN.

151a or b. **History of Chemistry.** Prerequisites, courses 111 and 131. May be taken with course 131. (3)

200. **Chemistry of the Rare Earths.** Prerequisite, course 121. Occurrence, distribution, properties, and uses of the rare earths. (3) Mr. BROWN.

211a. **Advanced Organic Chemistry.** Prerequisite, course 111. Lectures on selected topics (such as heterocyclic compounds, stereoisomerism, carbohydrates, etc., supplemented by reading and reports on classical researches. (3) Mr. CALVERT.

212b. **Advanced Organic Chemistry.** Prerequisite, course 111. Lectures on selected topics, supplemented by reading and reports on classical researches. In the selection of the subjects the special needs of the students will be considered. (2) or (3) Mr. CALVERT.

221. **Advanced Quantitative Analysis.** Prerequisite, course 121. Chiefly laboratory work. The complete quantitative analysis of rocks, ores, minerals, slags, and various commercial materials and products. The work of the course is varied to meet the needs of the individual. Credit to be arranged. Mr. GIBSON.

232a or b. **Advanced Physical Chemistry.** Prerequisites, courses 131 and 121. Lectures on selected topics, supplemented by reading and reports on classical researches. A reading knowledge of German and French is very desirable. Credit to be arranged. Mr. SCHLUNDT.

260. **Seminary.** Meetings at which subjects of a chemical interest are discussed by students of sufficient attainment and members of the teaching staff. A reading knowledge of French and German is desirable. (1)

271. **Research.** Research is offered in the following lines of work: general, organic, analytical, physical, electro- and radio-chemistry, and micro-metallography. Arrangements for research should be made by consultation with the instructor with whom the research is elected.

The University of Missouri Section of the American Chemical Society meets monthly. Students may attend these meetings.

GEOLOGY AND GEOGRAPHY

100a. **Economic Geology.** Prerequisite, course 1a or b, or 2a or b. Deals with coal, oil and gas, clays, building stones, cement materials, gypsum, fertilizers, and various minor products. Their geographic distribution, mode of occurrence, uses, origin, and conservation are studied. The department has a good collection of these products which are studied in the laboratory. Field trips to mines and quarries near Columbia. (3) Mr. TARR.

101b. **Economic Geology.** Prerequisites, course 1a or b, or 2a or b, and elementary chemistry. Considers the deposits of gold, silver, copper, iron, lead, zinc, aluminum, and minor metals; their geographic distribution, mode of occurrence, origin, uses, production, and conservation. (3) Mr. TARR.

102a. **Advanced Physiography.** Prerequisite, course 1a or b, or 2a or b. A lecture, text-book, and conference course intended for those who wish to do advanced work in geology and for those who expect to teach physiography in secondary schools. The method will be topical and considerable reading will be required. (3-5) Mr. THOMAS.

103. **Historical Geology.** Prerequisite, course 1a or b. Hypotheses for the origin of the earth, principles of sedimentation, distribution and kinds of rocks of each geologic period, geographic changes of the North American continent, causes for geographic changes, climate of each period. Several field trips. (3) Mr. BRANSON.

104. **Geologic Life Development.** Prerequisite, course 1a or b, and a course in zoology. Changes that have taken place in the life of the earth from its first appearance to the present and the causes for these changes. The life of each geologic period is considered as a whole and in its relation to the life of the preceding and following periods. In the laboratory, students examine specimens that illustrate the gradual evolution toward living types. (2) Mr. BRANSON.

105. **Field Course.** Prerequisite, 5 hours of geology. Offered in the summer session. Intended as preparatory for advanced work in geology and as a basis for the teaching of geology and physical reography. The field work consists of mapping the areal geology, describing the sedimentary formations, igneous and metamorphic rocks, collecting in a systematic way from the formations, and reporting on the structural geology, physiography, and economic products of a small area in Colorado or Wyoming. Special topics are assigned to graduate students, and this work may form the basis for masters' or doctors' theses. (8) Mr. BRANSON.

106a. **Mineralogy.** Prerequisite, course 1a or b, or 2a or b. Elements of crystallography based upon lectures and work with models and crystals. Physical and chemical properties of minerals; detailed descriptions of their mode of occurrence, geographic distribution, and origin. In the laboratory, after preliminary preparation with the elements, unknown minerals are given the student for determination. (5) Mr. TARR.

107b. **Petrology.** Prerequisite, courses 106a, 108b, inorganic chemistry, and general physics. Principles of optics as applied to the polarizing microscope, optical properties of the rock-forming minerals, microscopic and megascopic study of the various rock groups. (5) Mr. TARR.

108b. **Rocks and Rock Minerals.** Prerequisite, course 1a or b, or 2a or b. A study of the various kinds of common rocks and of the minerals that constitute them. A field classification is followed in the laboratory and the methods pursued are those which would be used in the field. The lectures deal with the origin, geologic features, economic properties, and weathering of rocks. Designed for those who wish a general knowledge of rocks as well as for geologists, engineers, architects, agriculturists. (3) Mr. TARR.

111b. **Field Geology.** Topographical and geological surveying carried on in the vicinity of Columbia. Offered as field training for geologists, topographers, civil engineers, and soil surveyors, or students who intend to take up work of this kind. (1 or 2) Mr. BRANSON.

200b. **Geology of Oil and Gas.** Prerequisites, course 1a or b, or 2a or b, and 100a, 103b, and 108b. Occurrence, origin, and methods of accumulation of oil and gas. Location of wells; development of oil and gas properties; oil and gas fields of North America. (3) Mr. TARR.

202a. **Stratigraphic Geology.** Prerequisite, courses 103b and 104a. Lectures, map work, and field work on the stratigraphy of North America, with more intensive study of a limited area. (5) Mr. BRANSON; Mr. GREGER.

203b. **Paleontology.** Prerequisite, course 104a; zoology of invertebrates and comparative anatomy of vertebrates a.e desirable antecedents. A somewhat detailed study of a few of the main groups of invertebrates or vertebrates with reference to their evolution and distribution previous to the present period. The content of the course will be varied to suit the needs of individual students. (5) Mr. BRANSON; Mr. GREGER.

204. **Seminary.** Geological literature and history. (1 or 2) Mr. BRANSON; Mr. TARR.

205. **Research.** Offered by members of the department in their respective lines.

206a. **Missouri Stratigraphy.** Field excursions to type stratigraphic sections in Missouri. Collections and reports. (1 or 2) Mr. BRANSON.

207b. **Economic Geology and Petrology of Missouri.** Field excursions to regions of important economic deposits. Collections and reports. (1 or 2) Mr. TARR.

GEOGRAPHY

109a and b. **Geographic Literature.** A reading course for students capable of doing semi-independent work. Reading may be along several lines, pedagogical, regional, economic, historical. Written reports required. (3-5) Mr. THOMAS.

110a. **Geography of North America.** Prerequisite, fifty hours of college credit, or course 1a or b, or 6a. Physical features, climate, plant life, animal life, and mineral resources of the continent; their influence on the distribution of population, localization and development of industries, development of transportation, growth of cities, and the historic development of the various countries. (3) Mr. THOMAS.

112b. **Geography of Europe.** Prerequisite, fifty hours of college work, or course 1a or b, or 6a. Relation of Europe to other continents; influence of location, area, topography, and climate on its development; character, distribution, and use of natural resources. Progress of different countries compared. Political boundaries and geographic conditions underlying European affairs. (3) Mr. THOMAS.

MATHEMATICS

It is especially recommended that students intending to specialize in mathematics should take courses in French and German in the preliminary work; but an extensive knowledge of the literature of those languages is not necessary.

Before electing any of these courses, the student should consult the instructor. Except where noted, the calculus is a prerequisite.

Courses 100a and 101b are prerequisite to all courses above 200 except 205 and 251.

100a and 101b. **Second Course in Calculus.** This course should be taken by all wishing to specialize in mathematics. (3) Mr. KELLOGG.

105a or b. **Advanced Algebra.** Prerequisite, courses 2 and 4. This course will include determinants, theory of equations, and applications of algebra to geometry. (3) Mr. WESTFALL.

110a and 115b. **The Historical Development of Mathematics.** (3) Mr. AMES.

120a and b. **Differential Equations and Their Applications.** (3) Mr. INGOLD.

130a. **Applications of Analysis.** A study of the differential equations, the series, and the integrals most essential to the mathematical sciences. (3) Mr. KELLOGG.

155a or b. **Mathematics of Business and Insurance.** Prerequisite, course 1 or its equivalent. (3) Mr. WESTFALL.

160a or b. **Probabilities and Statistics.** Prerequisite, course 1 or its equivalent. (3) Mr. WESTFALL.

200a or b. **Seminary.** The members of the staff will conduct work in reading and research in private with students prepared for such work. The nature and amount of the work done may vary materially. The course may be elected repeatedly in different semesters for different work and for any number of hours sanctioned by the instructor.

The following courses will be given in alternate years:

220b. **Fourier's Series and Allied Series.** (3) Offered 1918-19. Mr. KELLOGG.

225b. **Potential Functions.** (3) Mr. KELLOGG.

230a and 231b. **Theory of Functions of Real Variables.** (3) Mr. HEDRICK.

240a and 241b. **Theory of Functions of Complex Variables.** Offered 1918-19. (3) Mr. HEDRICK.

The following courses are offered from time to time, but not necessarily every year.

210a or b. **Differential Geometry.** (3) Mr. INGOLD.

215b. **Projective Geometry.** (3) Mr. INGOLD.

280a or b. **Calculus of Variations.** (3) Mr. WESTFALL.

251a or b. **Seminar in Actual Science.** (3) Mr. WESTFALL.

Mathematical Clubs. The students of the department conduct, for the discussion of mathematical topics, a club to which all persons interested are eligible. The members of the staff of the department hold regular meetings for the discussion of current literature and of recent research, which are open also to qualified graduate students.

PHYSICS

Students intending to specialize in physics should also take mathematics. Even in the less mathematical courses, some knowledge of calculus is of great advantage.

The following group of four courses constitute together a general course in advanced physics. It is recommended that students who have had the necessary preparation in mathematics elect 114a and 110b in their junior year, 112a and 113b in their senior year, though any one of the four may be chosen without the others. None of them include laboratory work, but students who desire advanced laboratory work in physics would do well to elect, along with these courses, the corresponding courses in the group 106a, 107a and b, 108b. Physics 3a and 4b, or their equivalent, are prerequisite for any of the following courses.

114a. **Mechanics.** Calculus is prerequisite, unless it be taken concurrently. (3) Mr. STEWART or Mr. REESE.

110b. **Electricity and Magnetism.** This course is not mathematical in the same sense as course 207; still it contains some theoretical work. Lectures and recitations. (3) Mr. STEWART.

112a. **Heat.** (3) Mr.—.

113b. **Light.** (3) Mr. REESE. The work of these two courses is largely descriptive, but contains some theoretical work in which an elementary knowledge of calculus is desirable though not essential. The course in heat includes some thermodynamics, one of the fundamental branches of Physics.

The following three courses consist entirely of laboratory work. Any one of them must be preceded either by courses 1 and 2 or by 3a and 4b

or their equivalent. They offer training in the more exact methods of laboratory measurements:

106a. **Mechanics and Heat.** Not given in 1917-18. In mechanics, angular motion, acceleration of gravity, conservation of momentum, moment of inertia, elasticity, etc., are studied; in heat, such things as specific heats, heats of combustion, vapor densities, and different methods of measuring high and medium temperatures. Work in mechanics or in heat, or in both, may be selected to suit the individual needs of the student. (1) or (2) Mr. REESE.

107a and b. **Electricity.** This course is much the same as the laboratory work in course 104a. (1), (2), or (3) Mr. —.

108b. **Light.** Measurements of wavelengths by interference methods, determination of refractive indices, study of polarization and the resolving power of optical instruments, etc. (1) or (2) Mr. REESE.

109a and b. **Advanced Work in General Physics.** This course, largely laboratory work, will be adapted to meet the needs and attainments of individual students. A student may be assigned a definite problem, the literature of which must be studied and the experimental work performed with the care of original research. (1), (2), (3), or (4) Mr. STEWART; Mr. REESE.

104a. **Electrical Measurements.** Two lectures and three laboratory periods. In the lectures is given an introduction to the mathematical theory of electricity and electrical measurements. The laboratory work consists of such work as comparisons of resistances by Kelvin double bridge and Carey Foster methods; determination of temperature coefficients; comparison of electromotive forces of cells; various uses of the potentiometer; comparison and absolute measurement of the coefficients of self and mutual induction; calibration of ammeters and voltmeters; photometric work with incandescent lamps. (3), (4), or (5) Mr. —.

121b. **Electrical Waves.** Theory and applications. (2) Mr. STEWART.

Courses 201a, 202b, 205 and 207 are courses in mathematical physics.

201a. **Thermodynamics.** Not given 1917-18. Lectures on the classical theory, with applications to certain branches of physical chemistry and electricity. Prerequisites, two years of physics, and differential and integral calculus. (3) Mr. REESE.

202b. **Special Theoretical Problems.** Statistical mechanics, heat radiation, and related problems, with an introduction to the quantum theory. Prerequisites, two years of physics, and differential and integral calculus. Some preliminary acquaintance with differential equations and the more general principles of mechanics is also desirable. (3) Mr. REESE.

205. **Theory of Light.** Not given in 1917-18. Prerequisites, calculus and two years work in physics. Some attention is given to geometrical optics, the major part is devoted to the electromagnetic and electronic theories. Lectures and recitations. (3) Mr. STEWART.

207. **Theory of Electricity and Magnetism.** Prerequisite, calculus and two years of physics; differential equations recommended. Fundamental concepts and vector equations of the electromagnetic field. Electron theory. Radiation. Relations between electricity and matter. Atomic theories. Lectures and recitations. (3) Mr. STEWART.

Courses 205 and 207 will not both be given in the same year.

209a and 209b. **Seminary.** Critical reading and discussion of current research work in physics. A colloquium in which all members of the teaching staff of the department and students of sufficient attainments take part. (1)

211a and b. **Research Work.** Hours to be arranged. Mr. STEWART; Mr. REESE.

GROUP OF BIOLOGICAL SCIENCES

ANATOMY

102a. **Gross Anatomy.** The study of the gross anatomy of the human body, with the exception of the central nervous system. (10) Mr. CLARK.

103b. **Histology.** The study of the microscopic anatomy of the tissues and organs of the human body. (6) Mr. JOHNSON; Mr. APPLEBY.

104b. **Neurology.** The study of the gross and microscopic anatomy of the central nervous system and sense organs. (3) Mr. JOHNSON; Mr. BLOOMER.

105a or 105b. **Topographic Anatomy.** Prerequisite, course 102a. A study of the topography of the various organs with the aid of serial sections through the body. Laboratory. (2) Mr. CLARK; Mr. JOHNSON.

106b. **Study-Room Course in Anatomy.** Prerequisite, course 102a. Each year certain of the dissected parts of the human body are preserved and are available for informal study. This may be combined with a study of cross sections. Mr. CLARK.

206a and 207b. **Advanced Anatomy.** Prerequisite, course 102a, 103b, or 104b. Advanced work will be given in any of the special fields of anatomy, the amount and character of which will be varied to suit individual needs. Mr. CLARK; Mr. JOHNSON.

208 and 209b. **Research.** Problems of original investigation will be assigned in anatomy, histology, or embryology. A reading knowledge of French and German is required. Mr. CLARK; Mr. JOHNSON.

BOTANY

100a. **Plant Physiology.** Lectures and laboratory work on the physiology of the common cultivated plants, covering such topics as absorption, transpiration, synthesis of carbohydrates and proteins, digestion, translocation, respiration, growth, reproduction, and the reaction of plants to stimuli. (5) Mr. REED.

101b. **Ecology of Seed Plants.** Prerequisite, course 14b. The relation of plants to their environment, including a discussion of the origin, development, structure, and succession of plant formations. (2) Mr. MANEVAL.

102a. **Plant Pathology.** Courses 3a or b and 100a are desirable prerequisites. Life histories of important parasitic fungi and their pathological effects upon the host; isolation of parasites, technique of culture methods, and inoculation of the host. (3) Mr. REED.

103b. **Advanced Plant Pathology.** A continuation of the work as outlined under course 102a, which is prerequisite. Special emphasis on particular groups of diseases. (2) or (3) Mr. REED.

104a. **Histological Methods.** Methods used in the preparation and preservation of class material and in fixing, sectioning, and staining of sections for microscopical study. (2) Mr. DURAND.

105. **Comparative Morphology and Embryology.** Structure and life history of selected representatives of the great groups of green plants. Special attention will be given to tracing the development and homologies of sterile, sporogenous, and reproductive parts, such as the formation of spores and gametes, fertilization, the development of the embryo. (3) Mr. DURAND.

106b. **Plant Breeding.** The study of the cell as the unit of structure and function, and as the physical basis of heredity. Particular emphasis upon the fundamental principles of plant breeding including hybridization, Mendelian phenomena, etc. (3) Mr. REED.

107b. **Problems in Plant Physiology.** Prerequisite, course 100a. Lectures and discussions on physiological problems. The work in any given semester is confined to some special topic as mineral nutrients, photosynthesis, respiration, etc. Laboratory work on the subject considered may be elected for additional credit. (2-5) Mr. REED.

108b. **Diseases of Forest Trees.** Prerequisite, course 102a. Required of students in forestry. A study of the fungous diseases of forest trees, the fungi which cause decay in timber, and the methods of timber treatment. (3) Mr. REED.

111a and 112b. **Special Problems.** On consultation with the teachers concerned, properly prepared students may take up special problems in the various fields of Botany. Credit to be arranged. Mr. REED; Mr. DURAND; Mr. MANEVAL.

200 **Seminary.** Special subjects of botanical work will be taken up and discussed, including the results of investigations carried out in the department. A reading knowledge of French and German is essential. (1) Mr. REED.

201a and 202b. **Research.** Students who have had adequate preparation will be assigned some special problem for investigation. A reading knowledge of French and German is essential. Credit and hours to be arranged. Mr. REED; Mr. DURAND; Mr. MANEVAL.

PATHOLOGY

201a or 201b. **Advanced Pathology.** The amount and character of the work will depend upon the needs and qualifications of the student. In connection, opportunity will be afforded for practical experience in the handling of all kinds of morbid material. Hours to be arranged. Mr. DOLLEY; Miss GUTHRIE.

202. **Research.** Opportunity is offered to students sufficiently prepared for original investigation of unsolved problems in the fields of pathology and pathological physiology. A reading knowledge of German is required and French is recommended. A seminary is held once a week. Mr. DOLLEY.

203. **Normal and Abnormal Neurocytology.** The application of the general principles and theories of biology to the nerve cell in health and disease. The work will necessarily consist largely of original investigation and will be adjusted to the training of the student. Hours to be arranged. Mr. DOLLEY.

204a. **Pathological Physiology.** An experimental course. (2) Mr. DOLLEY; Miss GUTHRIE.

PHYSIOLOGY

101a. **General Physiological Chemistry.** Prerequisite, Chemistry, courses 110a and 111b or equivalent. Physiological chemistry of the carbohydrates, fats, and proteins; of the cell and special tissues; of the blood; of respiration; of metabolism; of secretions and excretions; and a quantitative study of the urine in relation to diet. (4) Mr. GULICK; Mr. JOHNSON.

103a. **Physiology of Secretion, Metabolism, and Reproduction.** The physiology of secretory processes, digestive mechanics, absorption, excretion, respiration, metabolism and energy exchange, heat regulation, and reproduction. (2) Mr. GREENE; Mr. BROWN.

105a. **Experimental Physiology.** The physiology of circulation, respiration, muscle and nerve, nervous system, and sense organs. (6) Mr. GREENE; Mr. BROWN.

108b. **Pharmacology.** The physiological action of drugs from the experimental point of view. The demonstrations are made on man and the lower animals. (4) Mr. GREENE; Mr. BROWN.

115a and 116b. **Advanced Physiological Chemistry.** A course supplementing and extending course 101a. The preparation and chemistry of the proteins; a qualitative and quantitative study of the tissues and secretions, of enzymes, of putrefaction and putrefactive products; analyses of typical foods; and the detection of food preservatives and adulterants. The prosecution of a short investigation and formal report on the same are required. (2-4) Mr. GULICK.

117a and 118b. **Toxicology.** Prerequisite, course 104a or 105b. (2 or 3) Mr. GULICK.

122b. **Physiology of Development and Growth.** Prerequisite, elementary physiology, 1a or 1b, or equivalent. A course of lectures and assigned reading, with special emphasis on factors that influence the capacities of the developing nervous system. (1) Mr. GREENE.

123a. **The Physiology and Pharmacology of the Circulatory System.** (3) Mr. GREENE.

226b. **The Physiology of the Nervous System.** (3) Mr. GREENE.

228a and b. **Journal Club.** (1) Mr. GREENE.

231a and 232b. **Advanced Physiology.** Elemental problems in physiology, physiological chemistry, or pharmacology will be assigned in preparation for research. Mr. GREENE; Mr. GULICK.

241a and 242b. **Investigation.** Opportunity is offered for research into questions of current interest in either of the fields represented. Mr. GREENE; Mr. GULICK.

PREVENTIVE MEDICINE AND BACTERIOLOGY

102b. **Medical Bacteriology.** Prerequisite, Botany, course 3a or 3b. Subjects studied include: relation of bacteria to disease; the fundamental principles of immunity, serum diagnosis, serum and vaccine therapy. The different diseases are discussed, and the micro-organisms causing them are studied in the laboratory, with animal inoculations and demonstrations. The course includes also the study of the most important diseases caused by protozoa. (4) Mr. RAVENEL.

201a and b. **Advanced Bacteriology.** Prerequisite, course 102a. Amount and character of work will depend on needs and qualifications of student. The manufacture of autogenous vaccines, the determination of the opsonic index, making and use of various sera, and the study of milk and water are among the subjects suggested. Hours to be arranged. Mr. RAVENEL.

202. **Research.** Prerequisite, course 102a. Students who are sufficiently prepared will be given problems requiring original investigation in the fields of bacteriology and public health. A reading knowledge of French and German recommended. Hours to be arranged. Mr. RAVENEL.

203. **Conduct of Public Health Laboratories.** Prerequisite, courses 102a and 201a. Designed for those who expect to take up such work as a profession or for teaching purposes. Graduates in medicine preferred. The collection and shipment of various specimens, their examination, milk and water problems, etc., will be discussed and the practical work carried out in the laboratory. Hours to be arranged. Mr. RAVENEL.

ZOOLOGY

100a. **Zoology of Invertebrates.** A comparative study of invertebrates. May be taken advantageously by students who expect to teach zoology. (5) Mr. CURTIS.

101a. **Embryology of Vertebrates.** Designed to lay the foundation

of vertebrate embryology. Successive stages in the development of the frog, the chick, and the pig are studied from preparations of entire embryos and from serial sections. These observations are used as a basis of comparison for the study of human embryology. (3) Mr. LEFEVRE; Mr. TANNREUTHER.

102a. **Animal Ecology.** A course dealing with the principles of ecology and including a study of the structure, activities, life-histories, distribution, and evolution of animals. (3) Mr. DODDS.

103b. **Cytology.** A study of the cell, with special reference to problems of development and inheritance. Cytological technique. (5) Mr. LEFEVRE.

104a. **Genetics and Evolution.** A course of lectures dealing with the experimental study of genetics and its relation to problems of organic evolution. Emphasis is laid on the phenomena of Mendelian inheritance and the mechanism of heredity. (2) Mr. LEFEVRE.

105a. **Protozoology.** A study of the biology of protozoa, with emphasis upon their relation to vertebrates; methods of culture and general technique. Of special interest to students of medicine and agriculture. (2 or 3). Mr. CURTIS.

106b. **Parasitology.** A study of the fundamental principles of parasitology; life histories and behavior of animal parasites; effects produced upon their hosts by parasites. Of special interest to students of medicine and agriculture. (2 or 3) Mr. CURTIS.

107a. **Comparative Histology.** A comparative study of the microscopic structure of animal tissues and organs. Microtechnique. (3) Mr. DODDS.

120a and 121b. **Special Problems.** Preparation for research in zoology. Hours to be arranged. (3) Mr. LEFEVRE; Mr. CURTIS; Mr. DODDS.

200 and 201b. **Research.** A reading knowledge of French and German is essential. Investigation of unsolved problems of zoology, in which the student is trained in the exercise of observation and thought. Hours to be arranged in accordance with the requirements of individual students. Mr. LEFÈRE; Mr. CURTIS; Mr. DODDS.

210a and 211b. **Seminary.** A reading knowledge of French and German is desirable. Meetings at which subjects of zoological investigation are discussed by instructors and students. Each student is required to give at least four lectures during the year, and experience is thus gained in presenting, in the form of lectures, the results of reading and research. (1)

HISTORY OF ART

111a. **History of Italian Renaissance Painting.** Lectures and collateral reading. Critical study of representative pictures by means of the best available reproductions. (3) Mr. PICKARD.

112b. **History of Renaissance Painting in the Netherlands and in Germany.** Lectures and collateral reading. Critical study of representative pictures by means of the best available reproductions. (3) Mr. PICKARD.

113. **Masterpieces of Architecture, Sculpture, and Painting of Classical, Renaissance, and Modern Times.** Lectures fully illustrated with the stereopticon. Aims to show the historical development of art by the discussion of some of the finest examples in each of the three divisions mentioned. (1) Mr. PICKARD.

216. **Seminary in the History of Art.** Hours and work to be assigned. Mr. PICKARD.

For courses in Classical Archaeology and Art, see pages 8 and 9.

THEORY AND PRACTICE OF ART

103. **Theory of Design.** Prerequisite, course 2a or 2b, while course 103 is advised in addition. A study of the essentials of architecture. (3) Mr. WELCH.

105b. **Pictorial Composition.** Prerequisite, course 4 or courses 2a or 2b and 103. Exception may be made to students possessing technique of photography. (3) Mr. ANKENY.

106. **Painting.** Prerequisite, course 4a, while course 103b is advised in addition. Lectures; practice in painting in several of the principal modes. (3) Mr. ANKENY.

107a and 108b. **Tone.** An advanced painting course. (3-5) Mr. ANKENY.

202a and 203b. **Problems of Design.** Not given in 1918-19. Prerequisite, course 103b and, possibly, 104 or 106. (2-5) Mr. ANKENY; Mr. WELCH.

204. **Problems of Form.** Prerequisite, courses 120a and 121b. An investigation of various theories of representation. (2) Mr. ANKENY.

208a and 209b. **Traditions of Painting.** Not given in 1918-19. Prerequisites, courses 103b, 105b, and 106. An investigation into the processes of the old masters with the adaptation of their traditions to modern work. (2-3) Mr. ANKENY.

231. **Problems in the Teaching of Art in Secondary Schools and Colleges.** In this course every possible opportunity will be given the student to conduct original investigation in some phase of this field. (2-5) Mr. ANKENY.

HOME ECONOMICS

101a. **Household Engineering.** Prerequisite, physiology, bacteriology, or preventive medicine. A study of the situation, ventilation, heating, lighting, water supply, drainage, and care of the house with reference to health, convenience, and cost. These problems will be considered from

the sanitary as well as the practical standpoint. Public sanitation, as it relates to the household, is considered. (3) Miss ROLFE.

100b. House Planning and Furnishing. Prerequisite, course 101a; preceded or accompanied by design. A study of the planning and furnishing of the house from the standpoint of convenience, economics, health, and art. The type of house is considered in relation to surroundings, materials used, size, cost, and adaptability to special needs of the family. House plans are studied and the equipment and decoration of each room is considered in detail, convenience and cost being especially emphasized. Each student plans and furnishes a house to suit certain definite conditions. (3) Miss ROLFE.

120a. Food and Nutrition. Prerequisite, organic chemistry, physiology, bacteriology, home economics 11b. A study of the chemistry of the foodstuffs and their occurrence in the different food materials; the digestion, absorption, and utilization of the foodstuffs, and the digestibility of different food materials and combinations; the preservation and adulteration of foods.

Laboratory work in chemical analysis and digestion experiments is related to work in food preparation and preservation. (5) Miss STANLEY; Miss LHAMON.

121b. Dietetics. Prerequisite, course 120a and its prerequisites. A study of normal food requirements and the nutritive value of different food materials and combinations. Dietaries are planned to meet definite conditions, and the meals prepared and served. The cost of the dietary and the relation between nutritive value and cost is emphasized. A special study is made of infant feeding, the feeding of children, and school lunches. (3) Miss LHAMON.

130a. Metabolism and Dietetics. Prerequisite, course 121b and its prerequisites. A consideration of the process of metabolism with particular attention to the elimination of metabolic end-products and their significance. The amount of food required to maintain the body in health is considered and the factors that determine this amount are worked out. Abnormal metabolic processes are considered as they throw special light on the problems of dietetics. (5) Miss STANLEY.

151. The Clothing Problem. Prerequisite, course 51 or 52, physiology, and organic chemistry. A study of the selection, construction and care of clothing for the infant child, and adult from the hygienic, social, and economic standpoints. This includes a study of the textile fabrics, their characteristics, manufacture, and cost, and the problem of household linens. (3) Miss ROLFE.

152. Advanced Clothing. Prerequisite, course 151 and design. A continuation of course 151, with special application of the principles of art, economics, sociology, and hygiene to the costume. (3) Miss ROLFE.

200. Home Economics Seminary. The most recent work in various lines of home economics will be reviewed and discussed. The line of work considered will be changed each semester so as to cover the field as com-

prehensively as possible. Open only to especially prepared seniors and graduates. (1) Miss STANLEY.

201. **Research in Food Preparation.** Special problems in the field of food preparation will be taken up for investigation. Open only to those who have had course 120 and chemistry 25a and b or its equivalent. A knowledge of French and German is desirable. Miss STANLEY.

220b. **Problems in Nutrition.** Prerequisite, course 121a. An intensive study will be made of special problems of interest in nutrition. Each student will investigate a nutritional problem in the laboratory and write a report upon same. Credit according to amount of work done. Miss STANLEY.

250. **Research in Clothing.** Open only to those who have had all the undergraduate courses in clothing with their prerequisites. A study of the problems involved in the hygiene and economics of the clothing supply. A reading knowledge of French and German is desirable. Credit according to the amount of work done. Miss ROLFE.

GROUP OF AGRICULTURE

AGRICULTURAL CHEMISTRY

101a and b. **Advanced Agricultural Chemistry.** A continuation of the regular undergraduate course in agricultural chemistry, which is required of all undergraduate students in agriculture. A critical study of methods in use in the chemical laboratories of the experiment station will be made, including an examination of foods and feeding stuffs for adulteration, etc. Three to five periods per week, including one lecture or recitation each week. Hours to be arranged. Mr. TROWBRIDGE; Mr. HAIGH; Mr. MOULTON.

200a and b. **Seminary.** (1) Mr. TROWBRIDGE.

201a and 202b. **Research.** May be elected either as major or minor and may include a thesis showing the results of the investigations. The chemical laboratories offer exceptional facilities for research. Subjects may be selected in (a) animal nutrition; (b) composition of animal fats as affected by feeding, age, breed, etc.; (c) the composition of meats, feeding stuffs, fertilizers, soils, etc.; (d) the chemical problems involved in the dairy industries; (e) the distribution of phosphorus in the animal organism with special reference to the separation of phosphorous compounds; (f) chemical problems involved in the enforcement of state and national pure food laws; (g) the separation of proteins of flesh and study of their hydrolytic cleavage products. (3-5) Mr. TROWBRIDGE; Mr. HAIGH; Mr. MOULTON; Mr. PALMER.

203a. **Chemistry of the Proteins.** A critical study of the composition and classification and of the decomposition products of the meat and vegetable proteins. Lectures and recitations. (3) Mr. TROWBRIDGE.

204a. **Physiological Chemistry of the Domestic Animal.** Designed to meet the requirements of students fitting themselves for investigation in animal nutrition. (3) Mr. PALMER.

ANIMAL HUSBANDRY

200. **Seminary.** Special investigation bearing on selected lines in animal husbandry. The preparation and presentation of papers for discussion by the class. (1) Mr. MUMFORD; Mr. ALLISON.

201. **Experimental Feeding.** Original investigations of important problems of feeding cattle, sheep, and swine. This course is intended to give experience in methods of experimental work and to make the student familiar with the most approved methods of investigation. (2) Mr. TROWBRIDGE; Mr. ALLISON.

202. **Research in Animal Husbandry.** Advanced studies of special phases of animal production. Recommended to students who desire more thorough training in the production of cattle, horses, sheep, or swine, or who may wish to make a more careful study of the fundamental principles of animal husbandry. Mr. MUMFORD; Mr. TROWBRIDGE; Mr. ALLISON.

203. **Animal Breeding.** Research in special subjects bearing on the inheritance and development of characters in the domestic animals. Mr. MUMFORD.

204. **Zoometry.** Special investigation of the relations of form and function in the domestic animals. Mr. TROWBRIDGE.

205. **Research in Stock Farm Management.** Investigations of the principles governing successful systems of stock farm management. Special studies of highly efficient stock farms. (2) Mr. MUMFORD; Mr. TROWBRIDGE; Mr. ALLISON.

DAIRY HUSBANDRY

100b. **Milk Production.** The breeds of dairy cattle; selection, breeding, and development of a dairy herd; care and management of dairy cattle; feeding for milk production; production of certified and market milk; milk for butter-making and cheese-making; utilization of by-products of the dairy. Mr. ECKLES.

201. **Seminary.** The object of this course is to train the student to do independent work and to develop the spirit of research. It consists of special investigation and study along selected lines of research with review and discussions of recent work. Each student presents papers on selected topics and reports on recent scientific investigations and on current literature of the subject. Mr. ECKLES.

202. **Research in Dairy Husbandry.** A large herd of highly developed dairy cattle representing four breeds makes it possible to offer facilities for study and investigation of a variety of subjects pertaining to milk production and the care and management of dairy cattle. Students interested in this line are allowed to carry out certain experiments with

the dairy animals and in some cases to assist in lines of investigation under way in the Agricultural Experiment Station. Mr. ECKLES.

203. **Special Investigations in Dairy Chemistry.** The chemical composition of milk, butter, cheese, etc., and the factors influencing their composition offer many attractive problems for graduate research. Unusual facilities are offered graduate students of good training in organic or agricultural chemistry to carry on independent investigations along the lines mentioned. The results obtained are usually of such a character that they can be published in one of the chemical journals. Mr. PALMER.

204. **Dairy Bacteriology.** This will be laboratory investigation of certain problems of bacteriology in relation to dairying, the object being chiefly to give training in methods of research in this line. The work will be adapted largely to the individual student. Mr. ECKLES; Mr. WERNER.

205. **Dairy Manufactures.** Opportunity and facilities are given to study and investigate problems in butter-making, cheese-making, and other lines of dairy manufactures. Mr. ECKLES; Mr. RINKLE.

ENTOMOLOGY

110b. **Advanced Economic Entomology.** A study of the insects of economic importance with special reference to those affecting horticultural crops, live stock, farm crops, the household, and man himself. Emphasis is placed on the study of the life history, injury, and methods of controlling them. (3) Mr. HASEMAN.

111a. **Morphology, Histology, and Development of Insects.** A technical study of the development of the insect from the egg to the adult. Special emphasis is placed on the study of the different tissues of the insect's body, the origin and development of the different structures of both the immature and the mature insect, and the changes the insect undergoes. In the laboratory the student is required to give special attention to the preparation of material for sectioning, the manipulation of the microtome, and the staining, mounting, and studying of serial sections. Lectures and laboratory work. (3) Mr. HASEMAN.

200a and b. **Research.** Opportunity is offered for original investigations in economic entomology, systematic entomology, and insect morphology. Mr. HASEMAN.

201a and b. **Seminary.** Reviews of current literature and reports on original investigations are presented and discussed by the students and members of the faculty. (1) Mr. HASEMAN.

FARM CROPS

101a. **Cereal Crops.** Prerequisite, course 1a or b. An advanced course dealing with the principal cereal crops, based largely on a study of experimental data. Two lectures and one laboratory period a week. (3) Mr. ETHERIDGE.

102a. **Forage Crops.** Prerequisite, course 1a or b. An advanced course dealing with the principal forage plants. Based largely on a study of experimental data. Two lectures and one laboratory period a week. (3) Mr. HELM.

103b. **Fiber Crops.** Prerequisite, course 1a or b. An advanced course dealing with the principal fiber crops, with special reference to cotton. (2) Mr. ETHERIDGE.

104b. **Field Crop Improvement.** Prerequisite, course 1a or b. A study of the laws of variation and heredity, the theory of mutation, the pure line theory, and Mendelism, as applied to the breeding of the principal farm crops. (3) Mr. McDONALD.

105. **Special Problems.** Primarily for advanced undergraduates who show proper preparation. Topics will be assigned or may be chosen subject to approval. Mr. ETHERIDGE; Mr. McDONALD; Mr. HELM.

201. **Research.** Original research in problems pertaining to the production, management, and improvement of farm crops. Mr. ETHERIDGE.

202. **Seminary.** Discussion of various phases of investigations pertaining to the production, management, and improvement of farm crops. Papers on assigned topics are presented by the students. Required without credit of graduate students majoring in Farm Crops. (1) Mr. ETHERIDGE.

FARM MANAGEMENT

112a. **Farm Records.** Prerequisite, course 105a. A study of farm financial surveys, enterprise surveys, and the general use of agricultural statistics in developing farm management principles. Special attention is paid to the recent use of such information in land appraisal work. (2) Mr. GREEN.

113b. **Farm Administration.** Prerequisite, course 110b. The application of the general principles gathered in course 110b to special farms. One lecture and one laboratory a week. (2) Mr. JOHNSON.

151b. **Special Problems in Farm Administration.** Prerequisites, courses 105a, 110b, 112a, and 114a. A detailed study of the organization of, and practices followed, on an approved farm, made by means of detailed records. Thesis required. Credit to be arranged. Mr. JOHNSON; Mr. GREEN.

152a. A continuance of 151b, which is a prerequisite to the course. Credit to be arranged. Mr. JOHNSON; Mr. GREEN.

200. **Seminar.** Selected literature and special field investigations of farm management problems. Mr. JOHNSON; Mr. GREEN.

207. **Investigation of Systems of Farm Organization and Farm Practices.** A study of systems of farm organization with emphasis on the details of this organization made by means of agricultural surveys and detailed cost accounting records. Thesis required. Mr. JOHNSON.

HORTICULTURE

105a. **Advanced Pomology.** The study of the principal species, types, and varieties of cultivated fruits and their related forms, together with a consideration of their variation, modifications, and adaptations under culture. The living plant collection on the horticultural grounds and a large number of varieties, types, and grades of apples, together with other varieties of fruits both in a fresh and a preserved state, afford material for study of types and varieties for exhibition and marketing purposes. (3) Mr. LAWRENCE; Mr. WHITTEN; Mr. WIGGANS.

107. **Plant Materials.** Trees, shrubs, and vines. Practical course designed to familiarize the student with the character, habits, and adaptation of ornamental trees, with special reference to their use in cities, parks, and private estates. This course is especially designed to train students for the positions of park superintendent, city forester or warden, nurseryman, or landscape plantsman and includes tree shaping and surgery, prunum and field work. Hours by appointment. (2) Mr. MAJOR.

115. **Special Problems.** Primarily for advanced undergraduates. Topics will be assigned to students who show proper preparation. Hours by appointment. Mr. LAWRENCE; Mr. WHITTEN; Mr. MAJOR; Mr. WIGGANS.

200. **Special Investigation.** For graduates and advanced students. Special problems for investigation will be assigned. Hours by appointment. Mr. LAWRENCE; Mr. WHITTEN; Mr. MAJOR; Mr. WIGGANS.

SOILS

101a. **Advanced Soil Fertility.** Prerequisite, course 1a. An advanced course dealing primarily with soil fertility. Laboratory exercises may include work on soils from the home farms of students. One lecture, two laboratory periods. (3) Mr. MILLER; Mr. ALBRECHT.

102b. **Soil Surveying.** Prerequisite, course 1a. Actual field practice in mapping soils and in the preparation of detailed soil maps. Course designed to fit men for soil survey field work. (2) Mr. KRUSEKOPF.

104a. **Soils of the United States.** Prerequisite, course 1a. The soils of the United States, their characteristics, crop adaptations and the systems of farming to which they are adapted. Particular attention given the soils of Missouri. (2) Mr. MILLER.

105a. **Soil Bacteriology.** Prerequisite, general bacteriology. Micro-organic life of the soil in relation to soil fertility, including studies of nitrogen transformations, decay of farm manures, soil inoculation and other biological processes. One lecture, two laboratory periods. (3) Mr. ALBRECHT.

106. **Special Problems.** Assigned problems in soil physics, fertility or biology in connection with certain experiment station projects, or problems chosen by the student with approval. Hours by arrangement. (2-3) Mr. MILLER; Mr. ALBRECHT.

200. **Seminar.** Discussions of recent developments in soil science. Papers on assigned topics are presented for discussion. (1) Mr. MILLER.

201. **Soil Research.** Special investigations in soils. Mr. MILLER; Mr. ALBRECHT.

VETERINARY SCIENCE

201. **Topographic Veterinary Anatomy.** Prerequisite, course 1a. A study of the topographic anatomy of the horse, ox, and pig by means of serial cross-sections of preserved cadavers, supplemented by a study of anatomical surface points on the living subject.

This course is designed to meet the needs of advanced students who intend to specialize in animal husbandry along the lines of stock judging and meat production. (3) Mr. CONNAWAY.

202. **Contagious, Infectious, and Parasitic Diseases of Farm Animals.** In this course an effort is made to present as many clinical cases as possible, in order that the student may gain a practical knowledge of the clinical features as they are encountered in field experience. Experimental inoculations supplement the clinical study. Autopsies are made and the gross and microscopic lesions studied. The specific causes (bacteria and other micro-parasites and macro-parasites), where known, are isolated and studied. Such ground relating to this group of diseases as has been well covered in the minor course 3a is not repeated in this course. Text and reference books: Hutyra and Marek's *Veterinary Pathology*; Law's *Vet. Med.*, IV; Ostertag and Wilcox's *Meat Inspection*; Neumann's *Parasites and Parasitic Diseases*; Nocard and Leclainche's *Les Maladies Microbiennes des Animaux*; Kitt's *Bacterienkunde*; Herzog's *Disease Producing Microorganisms*. Special bulletins and veterinary journals. Lectures, assigned reading, clinics, and laboratory work. (3) Mr. CONNAWAY.

203. **Investigation.** Students who have suitable preparation will have an opportunity to assist in the agricultural Experiment Station work. Studies on immunity in relation to hog cholera, infectious abortion in cattle, and roup in chickens will be continued during the coming session. (6) Mr. CONNAWAY.

GROUP OF ENGINEERING

CHEMICAL ENGINEERING

For the courses in Chemical Engineering see Chemistry, courses 110a, 111b, 121, 131a, 133b, 141a, 142b.

CIVIL ENGINEERING

112b. **Railway Engineering.** Complete estimates for railway lines; track construction; railway structures; railway economics. (3) Mr. MILLER.

141a. **Water Power.** Hydrology; stream measurement, weirs, current meters; storage reservoirs, dams; water wheels; the problem of a water power development. (3) Mr. RODHOUSE.

157b. **Sanitation and Sanitary Design.** General sanitation; garbage reduction; street cleaning; design of works for sewage disposal and water purification. (2) Mr. McCAUSTLAND.

201. **Geodetic Surveying.** Elements of geodesy, with practice in use of precise instruments and reduction of triangulation. (3) Mr. WILLIAMS.

214a. **Railway Maintenance.** Maintenance of track; signals; organization of engineering department; accounting. (3) Mr. MILLER.

215b. **Railway Yards and Terminals.** Arrangement of terminal facilities for handling of both passenger and freight business; design, construction, and operation of yards of several kinds and types. (2) Mr. MILLER.

222a. **Structural Design.** Design of wooden stringer bridge, I-beam stringer bridge, and steel railway truss bridge, with working drawings and estimates. (3) Mr. HYDE.

223b. **Higher Structures.** Swing bridges; arches; suspension and cantilever bridges; deflection of trusses. (3) Mr. HYDE.

226a. **Concrete Structures.** Theory of reinforced concrete structures with problems in design. (3) Mr. SPALDING.

227. **Theory of Structures.** Statically indeterminate structures; secondary stresses. Credit to be arranged. Mr. HYDE.

231. **Experimental Investigation.** Hydraulic laboratory. Laboratory investigations concerning the properties and uses of the materials of construction. Credit to be arranged. Mr. SPALDING.

243a. **Irrigation and Drainage.** Irrigation engineering, institutions, and practice; canals; ditches, reservoirs; land drainage. (2) Mr. RODHOUSE.

244b. **Rivers and Canals.** River improvements, training works, floods, levees, dredging, shore protection; waterways, canals and locks; river discharge. (2) Mr. RODHOUSE.

251. **Sanitary Engineering.** Investigations and special problems in sanitary engineering. Credit to be arranged. Mr. McCAUSTLAND.

ELECTRICAL ENGINEERING

131b. **Electric Motors.** Prerequisite, course 101. Construction, characteristics, and application of electric motors to various classes of service. (2) Mr. WEINBACH.

132a. **Storage Battery Engineering.** Prerequisite, course 102a. Theory, operating characteristics, and application of electric storage batteries. (2) Mr. WEINBACH.

133a. **Illumination.** Prerequisite, course 101. Characteristics of commercial types of electric lamps and their application to interior and exterior lighting. (2) Mr. SAVANT.

134b. **Telephony.** Prerequisite, course 110a. Design and operation of telephone systems. Switchboard systems. Types of line construction. A few periods are devoted to laboratory work. (2) Mr. SAVANT.

143a. **Electrical Processes.** Not offered in 1917-18. Prerequisite, course 101. Miscellaneous practical applications of electricity in electrochemical and metallurgical industries, including electroplating; electric welding; the theory, construction, and operation of electric furnaces. (2) Mr. WEINBACH.

221a. **Problems in Alternating Current Design.** Prerequisites, courses 111b and 120b. Rational treatment of design problems relating to alternating current machinery. (2) Mr. LANIER.

230a. **Generation and Distribution.** Prerequisite, course 111b. Detailed study of the generation, transmission, and distribution of electrical energy for lighting, power, and electric railways. (3) Mr. WEINBACH.

240b. **Central Station Design.** Prerequisite, course 230a. Selection and arrangement of equipment of electric power plants. Plans and designs of power plant. (2) Mr. LANIER.

241b. **Electric Railway Engineering.** Prerequisite, course 102a and 111b. Electric railway systems; equipment and operation. Economic conditions governing the construction of an electric road. (2) Mr. WEINBACH.

242b. **Transmission.** Prerequisite, course 230a. Transmission of electric power. Line regulation. Economical aspects, practical limitations, operating precautions. (3) Mr. WEINBACH.

244b. **Analysis of Design Problems.** Not offered in 1917-18. Prerequisite, course 221a. An analysis of some of the more important problems relating to the design of electrical machinery. (2) Mr. LANIER.

250a. **Special Electrical Laboratory.** This course will be adapted to meet the attainments of individual students. Definite problems will be assigned which must be studied by existing literature and by experimental work. (2) Mr. LANIER.

280b. **Applications of Mathematics to Electrical Engineering.** Prerequisite, mathematics, course 6. Stating the problem in mathematical form; approximate solutions; derivations of empirical formulæ; solutions of equations by graphical methods; application of complex numbers, exponential functions, and differential equations to electrical engineering problems. (2) Mr. WEINBACH.

290. **Research.** Original investigations along various lines in electrical engineering. Students taking research work will have as advisers those members of the staff most conversant with the problem undertaken.

MECHANICAL ENGINEERING

172b. **Engineering Charts.** Theory and construction of charts for the purpose of expediting the solution of various formulae. (1) Mr. FOSTER.

201a and b. **Special Machine Design.** Advanced work in kinematics, graphics, materials and the design of apparatus and machinery for specific work. Credit to be arranged. Mr. FOSTER.

211b. **Shopwork Engineering.** Advanced analysis in production-engineering. Industrial betterment. New mechanisms in scientific management. Tests in laboratory and in commercial plants. (2) Mr. HIBBARD.

221a a d b. **Special Mechanical Laboratory.** Advanced work in experimental engineering research. Credit to be arranged. Offered by members of the staff in their respective lines.

234. **Gas Engineering.** Prerequisites, machine design, B, heat machinery, B. Production, preparation, transmission, and utilization of industrial gases; together with the theory and practice of internal-combustion motors. (2) Mr. WHARTON.

251b. **Refrigeration, B.** Prerequisite, refrigeration, A. Designs, plans, specifications, estimates for one or more selected studies, as: ice factory, cold-storage, district refrigeration, nursery, market, etc. Research, tests, improvements, appraisals, sales, management. Credit to be arranged. Mr. WHARTON.

261a and 262b. **Railway Mechanical Engineering.** Prerequisites vary with group elected. 1. Locomotive design. 2. Locomotive operation. 3. Car design. 4. Railway shops. (2) Mr. HIBBARD.

231. **Applied Thermodynamics.** Prerequisite, heat machinery, B. The advanced theory and practice of heat transformations and appliances related to commercial economy in heat machinery. (3) Mr. WHARTON.

MECHANICS

112. **Advanced Mechanics.** Problems in dynamics. (3) Mr. DEFOE.

205. **Elasticity.** Mathematical theory of elasticity. (3) Mr. DEFOE.

209. **Hydrodynamics.** Material theory of the motion of fluids. (2) Mr. DEFOE.

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University of Missouri,
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Dairy Husbandry.

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Dairy Husbandry.

ALBERT JULIUS WINKLER, B. S., University of Texas,
Horticulture.

UNIVERSITY CALENDAR

Session 1918-1919

1918

Summer Session

- June 6..... Thursday, registration
 June 7..... Friday, organization of classes
 June 8..... Saturday, regular class work
 August 2..... Friday, final examinations

First Semester

- September 19, 20 & 21. Thursday, Friday and Saturday, entrance examinations
 September 23 & 24... Monday and Tuesday, registration
 September 25..... Wednesday, 8 a. m., class work in all divisions begins
 September 25..... Wednesday, 11 a. m., opening convocation
 October 30..... Wednesday, to } First term, two-year winter
 December 20..... Friday } course in agriculture
 November 27..... Wednesday, 4 p. m., to }
 December 2..... Monday, 8 a. m. } Thanksgiving recess
 December 20..... Friday, 4 p. m. to }
 1919 } Christmas holidays
 January 2..... Thursday, 8 a. m. }
 January 2..... Thursday, to } Second term, two-year winter
 February 28..... Friday } course in agriculture
 January 25..... Saturday, to }
 February 1..... Saturday } Final examinations

Second Semester

- February 3 & 4..... Monday and Tuesday, registration
 February 4..... Tuesday, 11 a. m., opening convocation
 February 5 Wednesday, 8 a. m., class work begins
 February 22..... Saturday, Washington's birthday, holiday
 April 16..... Wednesday, 4 p. m., to }
 April 22..... Tuesday, 8 a. m. } Easter recess
 May 31..... Saturday, to }
 June 7..... Saturday } Final examinations
 June 8..... Sunday, baccalaureate address
 June 11..... Wednesday, commencement day

INFORMATION ABOUT THE UNIVERSITY

GENERAL STATEMENT

The fundamental aim of the University of Missouri is the development of the highest and most efficient type of citizen. For the purpose of attaining its aim, the University furnishes ample facilities for liberal education and for thorough professional training. The University is a part of the public educational system of the state.

ORGANIZATION

The work of the University is now carried on in the following divisions:

- College of Arts and Science
- College of Agriculture
- School of Education
- School of Law
- School of Medicine
- School of Engineering
- School of Mines and Metallurgy
- School of Journalism
- School of Business and Public Administration
- Graduate School
- Extension Division

All of these divisions are at Columbia, with the exception of the School of Mines and Metallurgy, which is located at Rolla. In addition, emphasis is given particular lines of work by the establishment of minor divisions, the chief of which are the Agricultural Experiment Station, the Engineering Experiment Station, and the Missouri State Military School.

LOCATION

The University of Missouri is located at Columbia, situated half way between St. Louis and Kansas City, near the center of the state. It is reached by the Wabash and by the Missouri, Kansas and Texas railways. Columbia is a progressive and prosperous town having doubled its population in the last few years.

Columbia may be characterized as a town of schools, homes, and churches, with enough of industrialism to make it efficient. It offers the convenience of a larger city without the counter attractions. The student is a predominant factor in Columbia.

EQUIPMENT

The University grounds cover more than 800 acres. The main divisions are in the west campus, the east campus, the athletic fields, and the University farm.

The following University buildings are located at Columbia: Academic Hall; Laws Observatory; separate buildings for chemistry, physics, biology, geology, engineering, manual arts, law, business and public administration; two power houses; Medical Laboratory Building; Parker Memorial Hospital; Agriculture Building; Horticulture Building; Schweitzer Hall for agricultural chemistry; green houses; Live Stock Judging, Poultry, Dairy, Farm Machinery, and Veterinary Buildings; the agricultural college farm barns and buildings; Switzler Hall for the School of Journalism; Gordon Hotel Building for home economics; Lathrop Hall, dormitory for men; Read Hall, dormitory for women; Rothwell Gymnasium; the houses for the President of the University and the Dean of the College of Agriculture; and High School and the Elementary School buildings, used for practice schools in the School of Education. The new library building, containing the General Library and the State Historical Library, affords also commodious seminary rooms for the use of students in the graduate courses.

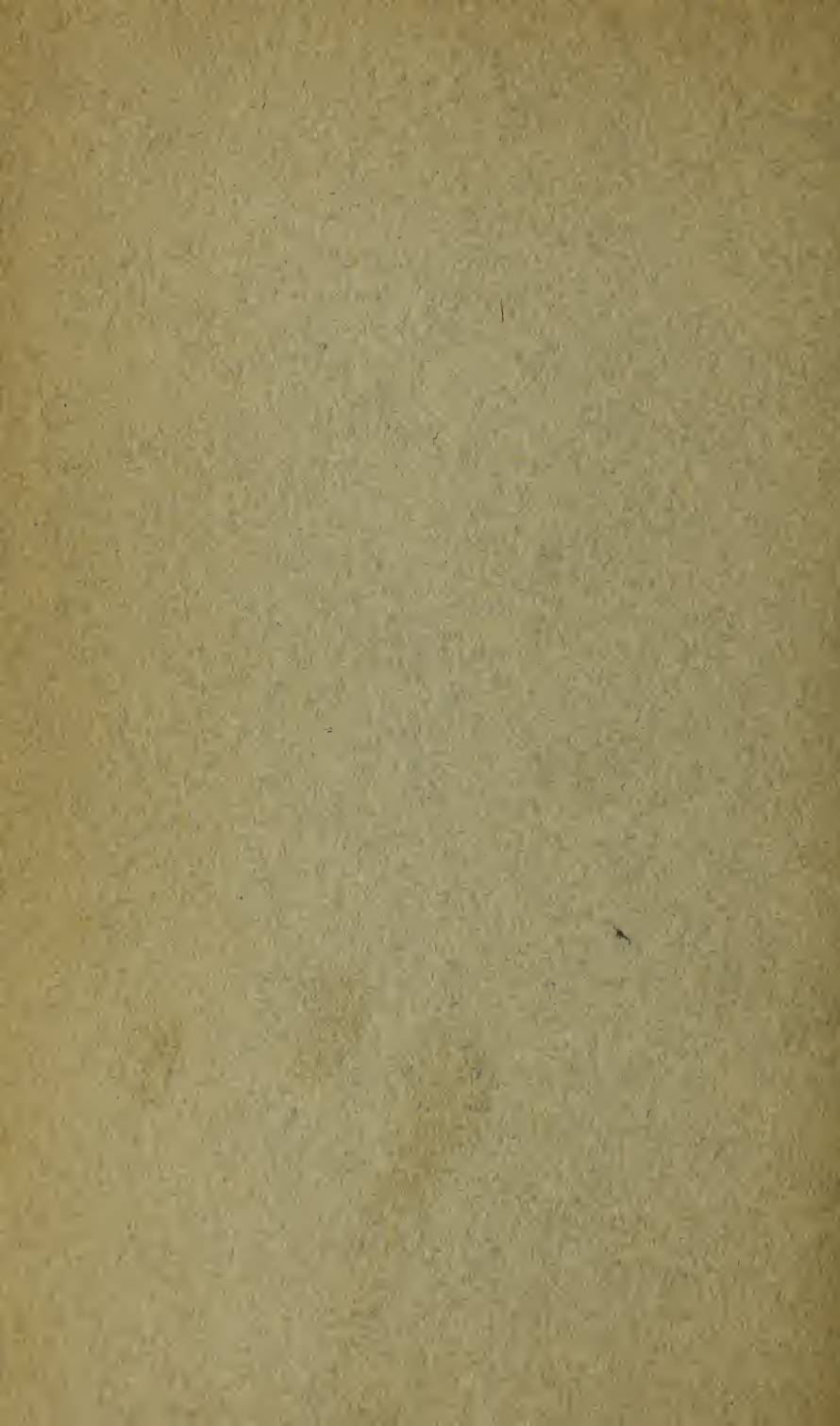
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For further information in regard to the Graduate School of the University, address

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Full information regarding the University is given in the catalog, which will be sent on request without charge. For this or special bulletins of the College of Arts and Science, College of Agriculture, School of Education, School of Law, School of Medicine, School of Engineering, School of Journalism, School of Business and Public Administration, Extension Division, and the Graduate School, write to

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COLUMBIA, MISSOURI.



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1919, NO. 3

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ANNOUNCEMENT 1919-20



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VOLUME 20, NUMBER 3

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Announcement of the Graduate School

GENERAL STATEMENT

Admission: Graduates of the colleges and universities comprising the Missouri College Union and of other reputable colleges and universities are admitted to the Graduate School. Admission to this school, however, shall not be understood as implying admission to candidacy for advanced degrees, which is subject to the regulations indicated below. Students are admitted to the Graduate School by the Registrar of the University to whom applications for admission should be addressed.

Fees and Expenses: Students are required to pay a library, hospital, and incidental fee of \$15.00 a term. Those who file their study cards after the close of the last day of registration will be required to pay an additional fee of \$5.00 for late registration. Students taking laboratory work must pay laboratory fees and deposits.

The estimated cost of room rent and board for students living in Lathrop Hall, the dormitory for men, varies, according to the room, from \$4.50 to \$5.00 a week. In Read Hall, the dormitory for women, it varies, according to the room, from \$7.00 to \$7.50 a week. The total necessary expenses of a student living in the dormitory for men need not exceed \$275.00 a year; in the dormitory for women they need not exceed \$375.00. The necessary expenses for students living in private families vary from \$5.00 to \$6.50 a week.

University Fellowships and Scholarships: The University offers annually a limited number of University Fellowships yielding each a stipend of \$400 a year. These fellowships will be awarded, according as the applicants, irrespective of department, have demonstrated their ability to render service in the form of research. The University offers also a limited number of scholarships bearing stipends of \$200 annually, open to graduate students of high promise in scholarship, irrespective of the lines of work they may desire to pursue. It is expected that scholars will be well qualified to do graduate work in the subjects which they elect and that they will devote themselves mainly to work in these subjects. They will be called upon to render a limited amount of service to the University. University fellows and scholars are allowed to engage in outside work only with the consent of the Dean of the Graduate Faculty and the professor of the subject which they elect. The Executive

Board, upon the recommendation of the dean and professor, may deprive any student of his fellowship or scholarship, whenever it may appear that he is not devoting himself as he should to his work as fellow or scholar. Applications must be filed not later than March 1, in order to receive consideration in the award for the following academic year. Applications received after this date and not later than June 1 will be considered in filling any vacancies that may occur in the fellowships or scholarships. Application blanks may be obtained from the Registrar of the University and when filled out should be sent to the Dean of the Graduate Faculty, Columbia, Missouri.

Gregory Fellowships and Scholarships: By the terms of the will of the late Charles R. Gregory of St. Louis, Missouri, the residue of his estate, amounting to approximately \$225,000, after providing for numerous bequests to charitable institutions, was left to the University of Missouri at Columbia to establish "The William Alexander Gregory Educational Fund." This must be invested by the Board of Curators "in a safe and prudent manner, the income from which shall be used in assisting white students of either sex in obtaining an education in any of the courses in said institution."

The Board of Curators has seen fit to provide that not more than \$1500 annually from this income may be used for the establishment and maintenance of fellowships and scholarships in the Graduate School to be known as the "Gregory Fellowships and Scholarships." These are awarded on the same conditions as the University fellowships and scholarships.

Peabody Fellowship in Education: In June, 1912, the trustees of the Peabody Education Fund gave the University the sum of \$6,000 on condition that it be held and used as an endowment of a Peabody Graduate Fellowship in education. The annual income from this fund will be paid to the holder of the fellowship.

Curators' Scholarships: By order of the Board of Curators, the student who attains the highest grade, or who shall be first in merit, in taking a bachelor's degree, in the graduating class of any of the colleges or universities composing the Missouri College Union will be admitted to this University for the first year without the payment of tuition, library, hospital, and incidental fees.

Agricultural Research Fellowships and Scholarships: The University offers annually a limited number of research fellowships in the Agricultural Experiment Station, each of the value of \$400, and scholarships, each of the value of \$200. It is the purpose of these fellowships and scholarships to foster and encourage original investigation and to give opportunity to students who desire to become efficient investigators in the field of agricultural science. All candidates for these fellowships and scholarships must fulfill the requirements for admission to the Graduate School of this University. (See page 3)

These fellowships and scholarships are available in the departments of agricultural chemistry, animal husbandry, dairy husbandry, horticulture, botany, entomology, farm crops, and soils. They will be awarded to the candidates who are best prepared and are of the highest promise in scholarship. Application blanks for these fellowships may be obtained from the Director of the Agricultural Experiment Station, Columbia, Missouri. Applications must be filed not later than March 1, in order to receive consideration in the award for the next academic year. Applications received after this date will be considered in filling any vacancies that may occur in these fellowships or scholarships.

Literary and Scientific Societies: A large number of literary and scientific societies is maintained in the University, with practically each department and each special field of interest represented. Some of these are conducted by members of the faculty and are open to advanced students. Others are conducted by students, in some cases with the participation of members of the faculty.

Honorary Societies: There is a number of honorary societies in the University, organized for the purpose of raising scholastic and cultural standards in their respective lines. In addition to the general literary society, Phi Beta Kappa, the scientific society, Sigma Xi, the social science society, Alpha Zeta Pi, the national musical fraternity, Phi Mu Alpha, and general honor societies, there are similar organizations in the schools of Law, Engineering, Medicine, Journalism, Education, Business and Public Administration, the Graduate School, the College of Agriculture, and in several of the departments.

Publications: The "University of Missouri Studies," several series in "The University of Missouri Bulletin," and the "Publications of the Agricultural Experiment Station" are maintained as a means of publishing the results of original research in the University by instructors and graduate students.

University Libraries, Laboratories, and Museums: **LIBRARIES.** The University libraries comprise the general library and many departmental libraries. They contain about 200,000 volumes and pamphlets. Students have access also to the library of the State Historical Society of some 65,000 volumes and pamphlets.

LABORATORIES. Facilities for research in the sciences are provided in the following laboratories: animal husbandry, anatomy, astronomy, bacteriology, botany, chemistry, agricultural chemistry, dairy husbandry, engineering (civil, electrical, sanitary, and mechanical), entomology, experimental psychology, educational psychology, farm crops, geology and mineralogy, home economics, horticulture, pathology, pharmacology, physics, physiology, physiological chemistry, soils, veterinary science, and zoology.

MUSEUMS. There are also museums of art, classical archaeology, ethnology, geology, and other collections.

Regulations Governing the Degree of Master of Arts: The degree of Master of Arts is offered to students who have spent at least two terms exclusively devoted to advanced courses of study and who have submitted an acceptable dissertation and passed all prescribed examinations.

A student wishing to make application for this degree must fill out a blank form, provided for the purpose, and must present it to the Dean of the Graduate Faculty on or before October first.

In order to be accepted as a candidate for the degree, the student must give evidence that he has completed an undergraduate course of study such as is offered by colleges of good standing and that he has received a baccalaureate degree equivalent to the baccalaureate degree of the University of Missouri.

In making application the student must indicate the subject of the dissertation and the course of study selected by him on the form referred to above, which must bear the signature of approval of the professor in charge of his major subject, before it is presented to the dean for final action. He may, however, defer submitting the subject of the dissertation to the dean until October fifteenth.

The candidate must choose a major subject, to which he must devote the greater part of his time during the year, and also such other subjects as may be approved. A majority of all work represented in the course of study must be selected from the courses strictly graduate in character.

A dissertation evincing capacity for original research and independent thought in the subject of the major work must be submitted to the Graduate Faculty for approval on or before April 1. The student should consult the Dean of the Graduate Faculty for information regarding the form in which the dissertation must be presented.

Each candidate for the degree of Master of Arts shall be required to pass final examinations; but the Graduate Faculty, upon the recommendation of the faculty of the department in which the candidate is taking his major work, may excuse the candidate from the requirement of a dissertation.

The attention of students is called to the fact that graduate work cannot be subjected to rigid regulation, and the Graduate Faculty reserves the right to deal with each case on its individual merits.

With the approval of the professors concerned, such candidates as have fulfilled all requirements may, at the close of the winter term, be recommended by the Graduate Faculty for the degree of Master of Arts.

Regulations Governing the Degree of Doctor of Philosophy:

1. **GENERAL STATEMENT.** The degree of Doctor of Philosophy is offered to students who have pursued advanced courses of study, without serious interruption, for a period of at least six terms and who have submitted an acceptable dissertation and passed all prescribed examinations.

In order to be accepted by the Graduate Faculty as a candidate for the degree of Doctor of Philosophy, the student must give evidence that he has completed an undergraduate course of study such as is offered by colleges of good standing and that he has received a baccalaureate degree equivalent to the baccalaureate degree of the University of Missouri.

The faculty reserves the right to decide in each case whether the antecedent training has been satisfactory, and, if any of the years of advanced work have been passed away from this University, whether they may be properly regarded as spent in university studies under suitable guidance and favorable conditions. Private study or study pursued at a distance from libraries and laboratories will not be considered as equivalent to university work. In any case, the student must spend the two terms immediately preceding his final examinations in residence at the University of Missouri.

It should be emphasized that the requirements for this degree are not computed in terms of time and courses, but that the degree is conferred only upon such students as have reached, after long study, a high attainment in some special branch of learning and have given the clearest evidence of their ability to carry on independent, original research by reason of having made an actual contribution to knowledge of a character approved by competent judges.

2. **ACCEPTANCE OF CANDIDATES.** A student wishing to make application for the degree of Doctor of Philosophy must fill out a blank form, provided for the purpose, secure thereto the signature of the instructor with whom he desires to take his major subject and present it to the Dean of the Graduate Faculty for approval on or before October first. He must also give satisfactory evidence of ability to translate French and German readily at sight.

3. **REQUIREMENTS FOR THE DEGREE.** (a) **Subjects of Study.**—Every candidate for the degree must select one principal or major subject and at least one and not more than two subordinate or minor subjects, the combination to be approved by the Graduate Faculty. The instructor with whom the student is taking his major subject acts as his official adviser and has the general direction of his work.

The student's principal work must be in the major subject. Altho no regulations are laid down with respect to the time to

be devoted to the major and minor subjects, in general it may be stated that the major subject should represent two-thirds of the student's entire time.

(b) *Dissertation.*—The dissertation, embodying the results of original investigation, must be written upon a subject approved by the adviser and must be submitted in typewritten form on or before April 1, when it becomes the property of the University. A brief biographical sketch of the writer must be appended to the dissertation. The student should consult the Dean of the Graduate Faculty for information regarding the form in which the dissertation must be presented.

Upon receiving the dissertation a committee is appointed whose duty it is to report upon it in writing to the Graduate Faculty.

The candidate is required to print or publish the dissertation, with such revision as the faculty may allow, and he shall present 150 copies of the work to the library of the University. The candidate is required to deposit \$50 to insure the publication of the dissertation within one year after the conferring of the degree.

(c) *Examinations.*—A committee, consisting of the professor of the candidate's major subject and the professors of his minor subjects, is appointed to take charge of all examinations and to report upon the same to the Graduate Faculty in writing.

In addition to final written examinations the candidate may be required to take an oral examination in the presence of the faculty.

(d) *Conferring of Degree.*—Upon the satisfactory completion of all requirements, the candidate may be recommended by the Graduate Faculty for the degree of Doctor of Philosophy.

COURSES OF INSTRUCTION

Courses preceded by a number with the letter f attached, thus: 104f, 106f, are given the fall term only. Those preceded by a number with the letter w attached, thus: 104w, 106w, are given the winter term only. Those preceded by a number with the letters sp attached, thus: 75sp, are given in the first half of the spring and summer term; those preceded by a number with the letters sm attached, thus: 80sm, are given in the second half of the summer term; while those preceded by a number with the letter s attached, thus: 90s, are given throughout the spring and summer term. The number of hours' credit given for a course for each term is indicated by the Arabic numerals following the statement of the course. Courses numbered 200 and above are strictly graduate in character.

GROUP OF CLASSICAL LANGUAGES

CLASSICAL ARCHAEOLOGY

106f. **Greek Art to the Age of Pericles.** A preliminary study of Assyrian and Egyptian Art, followed by a study of the development of Greek Architecture and Sculpture. (3) Mr. PICKARD.

107w and 107sm. **Greek Art from the Age of Pericles to Roman Times.** Continuing course 106. (3) Mr. PICKARD.

108f. **Mycenaean Art or Art of Primitive Greece.** (1) Mr. PICKARD.

109w. **Introductory Study of Greek Vases and Vase Paintings.** (1) Mr. PICKARD.

110f and 110sp. **Roman Life.** A study of the extant remains, particularly those of Pompeii. Lectures and readings. Illustrated by use of plans, maps, and lantern slides. (2) Mr. PICKARD.

118w and 118sm. **Topography and Monuments of Rome.** Illustrated by use of plans, maps, and lantern slides. (2) Mr. PICKARD.

214f and 215w. **Topography and Monuments of Athens.** Prerequisite, a reading knowledge of Greek, French, and German. Frazer's Pausanias will be taken as the basis of discussion. (2) Mr. PICKARD.

216f, 217w, and 216s. **Archaeological Seminary.** Hours and work to be arranged. Mr. PICKARD.

Museum of Classical Archaeology: The Museum occupies the third floor of the west wing of Academic Hall. It is supplied with models of temples representing the three orders of Greek architecture and with plaster casts of representative specimens of Greek and Roman sculpture. These are arranged chronologically, and on the walls are hung many framed photographs of other works of classic art. The museum possesses a large number of unframed photographs and an extensive collection of lantern slides.

GREEK

216w. **Hesiod and Homeric Hymns.** (3) Mr. SCOGGIN.

217f. **Homer: the Iliad and the Odyssey.** (2) or (3) Mr. MANLY.

218w. **Homer.** Continuation of 217f. (2) or (3) Mr. MANLY.

222f. **Seminary.** Graduate work conducted in accordance with the needs of the graduate students in classics. Mr. MANLY and Mr. SCOGGIN.

223w. **Seminary.** Continuation of 222f. Mr. MANLY and Mr. SCOGGIN.

LATIN

101f and w. **Latin Prose Composition.** Advanced course. Prerequisite, course 50. (1) Mr. SCOGGIN.

103f and 104w. **Roman Public and Private Life.** Not given in 1919-20. Prerequisite, courses 30 and 70. Reading of Cicero's correspondence and Juvenal's satires. (3) Miss JOHNSTON.

Students electing this course are advised to take with it course 109f in history.

106f and 108w. **Catullus and the Elegiac Poets.** Not given in 1919-20. Prerequisite, courses 30 and 70. Selected poems of Catullus, Tibullus, Propertius, and Ovid. (3) Miss CAUTHORN.

109f. **Latin Comedy.** Prerequisite, courses 30 and 70. Representative plays of Plautus and Terence. (3) Mr. SCOGGIN.

110f. **Tacitus: Annals.** Prerequisite, courses 30 and 70. (3) Mr. SCOGGIN.

111w. **Quintilian: Books X-XII.** The reading of the text to be accompanied by a study of the history of Greek and Latin literature. Prerequisite, courses 30 and 70. (3) Mr. SCOGGIN.

115f and 116w. **Rapid Reading.** Prerequisite, courses 103f and 104w, or equivalent. History of Latin literature, with readings from authors representative of each period. (2) Mr. MILLER.

125w. **Lucretius.** Prerequisite, courses 30 and 70. (3) Mr. SCOGGIN.

217f and w. **Seminary: Late Latin.** First term: Ammianus Marcellinus, Histories. Second term. Patristic Latin, with St. Augustine as the basis of study. (3) Miss JOHNSTON.

220s. **Virgil's Aeneid.** Intended primarily for teachers. Comparative literary study of epic poetry; structure and versification; antiquities and topography. (3) Mr. MILLER.

SANSKRIT AND COMPARATIVE PHILOLOGY

218f. **Historical Greek Grammar.** Phonology and morphology. The lectures will deal systematically with noun and verb inflection within the Greek language itself. The student should procure Brugmann's *Griechische Grammatik* and Solmsen's *Inscriptiones Graecae ad illustrandas dialectos selectae*. (3) Mr. SCOGGIN.

219w. **Historical Latin Grammar.** The sounds and inflections of the Latin language will be set forth briefly in lectures. The student should own Lindsay's *Latin Language* and the same author's *Latin Inscriptions*. (3) Mr. SCOGGIN.

220f. **Elementary Sanskrit.** Elements of the language. Translation of Sanskrit into English and English into Sanskrit. Thorough drill in forms. Whitney's *Sanskrit Grammar*; Lanman's *Sanskrit Reader*; and Perry's *Primer*. (3) Mr. SCOGGIN.

221w. **Continuation of 220f.** (3) Mr. SCOGGIN.

GROUP OF MODERN LANGUAGES

ENGLISH

101w. **Advanced Composition.** Informal courses in practical composition, open to a limited number of upperclassmen. (3) Mr. RANKIN.

101sm. **Advanced Composition.** (1½) ———.

106w. **Debating.** Investigation of special questions; practice in debate. Designed especially for members of the debating squad. (3) Mr. LEWIN.

108sm. **Dramatic Interpretation.** A study of selected plays; a discussion of the problems of the public presentation of plays; the acting of plays. (2) Mr. DEWEY; Mr. TISDEL.

109f. **Public Speaking.** The principles of public speaking, extemporaneous and formal; practice in writing and speaking. (2) Mr. DEWEY; Mr. TISDEL.

113w. **English Versification.** A study of the technique of English verse, with practice in metrical composition. (2) Mr. LEWIN.

119f and 120w. **The English Language.** The science of language; the present facts of the English language; the past development of English; an introduction to Old English. (3) Mr. RAMSAY.

121w. **Problems in English Usage.** Investigation of doubtful or contested points in style and syntax. (3) Mr. BELDEN.

125f. **Chaucer and His Time.** (Not given in 1919-20.) (3) Mr. RANKIN.

135w. **Shakespeare.** *Hamlet.* (3) Mr. FAIRCHILD

135sp. **Shakespeare.** *Othello* and *Tempest.* Six hours a week. (3) Mr. FAIRCHILD.

136sm. **Shakespeare.** *Julius Caesar* and *Macbeth.* Six times a week. (3) Mr. FAIRCHILD.

145w. **Milton.** Life, works, and times. (3) Mr. FAIRCHILD.

155f. **Dryden and Pope.** (Not given in 1919-20.) (3) Mr. BELDEN.

156w. **Swift and the Essayists.** (Not given in 1919-20) Mr. BELDEN.

161f. **The Novel.** The novel as a literary form, with special reference to the nineteenth century novel. (3) Mr. FAIRCHILD; Mr. BURROWES.

162w. **The Rise of English Prose Fiction.** The early forms of narrative in English; the development of the novel down to the opening of the nineteenth century. (3) Mr. FAIRCHILD; Mr. BURROWES.

162sm. **The Rise of English Prose Fiction.** (3) ———

165f. **The Romantic Period.** A comprehensive study of the works of representative authors in both prose and verse. (3) Mr. TISDEL.

165sp. **The Romantic Period.** A study of literary tendencies and representative authors. Five times a week. (2½) Mr. TISDEL.

166w. **The Victorian Period.** A comprehensive study of the works of representative authors in both prose and verse. (3) Mr. TISDEL.

167sm. **Later Victorian and Recent Literature.** The study of selected poems from Tennyson and Browning, followed by a rapid reading of some contemporary authors. (1½) Mr. FAIRCHILD.

171f. **Modern Prose Writers.** A study of the works of representative authors, with weekly reports and monthly essays.

175f and 176w. **American Literature.** (a) Sectional development; (b) growth of nationality; (c) present tendencies. (3) Mr. BELDEN.

178w. **Recent and Current English Literature.** A study of representative writers and literary movements of the last twenty-five years. (3) Mr. RAMSAY.

180w. **The Foreign Debt of English Literature.** The purpose of the course is to give the student some acquaintance with the greater literary masterpieces of the world and to indicate the nature and to some degree the extent of the influence which they have exerted upon English literature. (3) Mr. RANKIN.

219f and 220w. **Literary Criticism.** The history of critical theory with reading of standard works; current theories and problems. (3) Mr. FAIRCHILD.

219sm. **Literary Criticism.** (1½) Mr. FAIRCHILD.

221f and 222w. **Beowulf.** The study of the poem will be pursued as an exercise in Old English phonology, in text-criticism, and in the investigation of poetic principles and racial tradition. (3) Mr. BELDEN.

225w. **Middle English Literature.** (Not given in 1919-20) Mr. RANKIN.

226f and 227w. **Seminary.** Chaucer. (3) Mr. RANKIN.

228f. **The Popular Ballad.** (Not given in 1919-20) Mr. BELDEN.

233f and 234w. **Historical Grammar.** The origin and development of the English language with investigation of special topics. (3) Mr. RAMSAY.

235sp. **Elizabethan Drama.** History of the early Elizabethan drama; study of the works of Lyly, Kyd, Peele, Green, and Marlowe; the doubtful plays of Shakespeare. Three times a week. (1½) Mr. FAIRCHILD.

245sm. **Milton.** (1½) ———.

250f. **The English Epic.** The progress of the epic type in English literature, with special study of the greater English epics. (3) Mr. RAMSAY.

265f. **Wordsworth.** The investigation of special topics, historical and critical. (3) Mr. TISDEL.

267sp. **Tennyson.** (1½) Mr. TISDEL.

268w. **Browning.** Investigation of special topics, historical and critical. (3) Mr. TISDEL.

277f. **The Modern Drama.** (Not given in 1919-20) Mr. RAMSAY.

GERMANIC LANGUAGES

104f, w, and s. **Masterpieces in Modern German Drama, Lyrics, and Novel.** Intensive study, from the literary and cultural side, of a number of carefully chosen Modern German dramas, lyric poems, and novels. Parallel reading and reports. (3) Mr. ALMSTEDT; Miss STEWART.

105f. **Outline Course in German Literature.** The aim of the course is to acquaint the student with the most important works and movements in the evolution of German literary life. (3) Mr. HOFFMAN.

106w. **Lessing.** Lectures on Lessing's life and works; intensive study of Lessing, the dramatist and the critic; essays written in German; course conducted in German. (3) Miss STEWART.

107f, and s and 108w. **Schiller.** Lectures on Schiller's life and works; intensive study of Schiller's dramas and poetry; essays written in German; course conducted in German. (3) Mr. HOFFMAN; Miss STEWART.

109f and 110w. **Goethe.** Lectures on Goethe's life and works; intensive study of Goethe's poetry and dramas; essays written in German; course conducted in German. (3) Mr. ALMSTEDT.

111w. **Outline Course in Historical Grammar.** This course, together with course 105f, is arranged to meet the needs of the prospective teacher in German. Tho a knowledge of the older periods is desirable, it is not required. (3) Miss STEWART.

112f and s. **Advanced Composition and Conversation.** Advanced course in German theme-writing; discussions of grammatical, syntactical and stylistic points. This course is intended for teachers of German or for students who propose to become teachers of German; conducted in German. (2) Mr. HOFFMAN.

113f. **Middle High German.** Introductory course. For advanced seniors. The class will study *Der Arme Heinrich* by Hartmann von Aue. Translation of medieval idiom into modern German. (3) Mr. ALMSTEDT.

114f. **German Drama of the Nineteenth Century.** An outline course in modern German political, social, and cultural movements, reflected in certain typical dramatists of this period. Lectures; parallel readings; reports. (3) Mr. NOLLE.

212f and s. **German Literature of the Second Half of the 19th Century.** This course will consist of lectures and reports. During

the first term Hebbel, Ludwig, Freytag, and Wagner will be especially emphasized. The minor authors will be treated in lectures. The second term will be devoted to a study of the realistic writers of Germany, especially Hauptman, Sudermann, Wildenbruch, and Fulda. The foreign influence on these writers will be carefully considered.

(3) Mr. HOFFMAN.

213f. **Romanticism.** This course is intended to comprise an exhaustive study, as far as is possible, of German romanticists and their works and to show the relation of this movement to similar ones in other literatures. (3) Mr. HOFFMAN.

214w. **The Reformation and Renaissance (1500-1750).** The aim of this course is to give the student a clear view of the development and decline of the literary tendencies, forms, and ideals of this period, and the influences that help to develop them or to accelerate their decline. (3) Mr. NOLLE.

215w. **Middle High German.** Walther von der Vogelweide. Discipline in phonology, morphology, syntax; comparison of medieval with modern idiom; a study in lyric poetry. (3) Mr. ALMSTEDT.

217f. **Old High German.** Prerequisite, course 220w. Phonology and forms; critical reading of Old High German texts: Braune, *Althochdeutsche Grammatik* and *Althochdeutsches Lesebuch*. (3) Mr. ALMSTEDT.

218w. **Old Norse.** Prerequisite, course 220w. Phonology and forms; critical reading of one or more sagas. Texts: Heusler, *Altislaendisches Elementarbuch*; and Heusler, *Zwei Islaender-Geschichten*. (2) Mr. ALMSTEDT.

219f. **Old Saxon.** Phonology and forms; critical reading of the Heliand. A desirable antecedent, course 220w. (2) Mr. ALMSTEDT.

220w. **Gothic.** Phonology, morphology, and syntax; reading from Ulfilas; the relationship of Gothic to Indo-European and to later Germanic dialects; general introduction to the study of Germanic philology. (3) Mr. ALMSTEDT.

221f and 222w. **Current Publications.** (1) Miss STEWART.

223f and 224w. **Seminary.** Subject to be determined. For special students only. (2)

Other courses in Germanic languages will be arranged if the needs of the students require.

ROMANCE LANGUAGES

FRENCH

101f, w, and sp. **French Phonetics.** The organs of speech, sound formation, etc.; drill in French pronunciation. (1) Mr. MURRAY.

104f and w. **Elementary French Composition and Conversation.** Prerequisite, course 3. This course is designed to give students facility and accuracy in writing and speaking French and will be conducted entirely in French: French themes, dictation, explanation of texts, etc. (5) Mrs. HUDSON.

105f and w. **Advanced French Composition and Conversation.** Prerequisite, course 104f or w. Conducted entirely in French. (5) Mrs. HUDSON.

107w. **French Drama.** Lectures, reading, reports. (3) Mr. MURRAY.

108f. **General View of French Literature.** The general character of the literature in the more important periods will be studied. (3) Mr. MURRAY.

109sp. **The French Novel.** Lectures, reading, reports. (2½) Mr. MURRAY.

110sm. **The Classical Period in French Literature.** Lectures, reading, reports. (1½) Mr. ———

113f. **The Romantic Period in French Literature.** Lectures, reading, reports. (3) Mr. ———.

114w. **The Realistic-Naturalistic Period in French Literature.** Lectures, reading, reports. (3) Mr. ———.

115w. **Recent and Current French Literature.** Lectures, reading, reports. (3) Mr. MURRAY.

116f and 117w. **The Literature of the Sixteenth Century.** Not given in 1919-20. (2) Mr. WARSHAW.

212f and s, and 213w. **Seminary in French Literature.** Detailed study of some literary movement or representative writer. (2), (3), or (4) Mr. MURRAY.

214f. **General Introduction to Romance Philology.** (2) Mr. MURRAY.

215w. **Old French.** (2) Mr. MURRAY.

216f and 217w. **Seminary in Romance Philology.** Provençal, Old Spanish, Old Italian. (2) Mr. MURRAY; Mr. WARSHAW.

ITALIAN

121f. **Italian Composition and Conversation.** Prerequisite, course 20. Conducted entirely in Italian. (5) Mr. ———.

125f and 126w. **Dante.** The *Divina Commedia*. (3) Mr. ———

SPANISH

138f and sp. **Advanced Course.** Prerequisite, course 31 or equivalent. Rapid reading of Spanish and Spanish-American works; commercial correspondence; practical exercises in composition and conversation. (2) Mr. WARSHAW.

139w. **Modern Spanish Drama.** Prerequisite, course 31 or equivalent. Reading and discussion of selected plays, accompanied by practical work in composition and conversation. (2) Mr. WARSHAW.

140sm. **Spanish-American Life and Literature.** Open to all students, without prerequisites. This course will be given in English and no knowledge of Spanish is required. Cannot be counted toward the major in Modern Languages. (2) Mr. ———.

237f and 238w. **Seminary in Spanish Literature.** Individual work in some phase of Spanish or Spanish-American literature. (2), (3), or (4) Mr. WARSHAW.

GROUP OF PHILOSOPHY AND EXPERIMENTAL PSYCHOLOGY

EXPERIMENTAL PSYCHOLOGY

These courses are open only to students who have had an introductory course in general psychology.

102f and 112w. **Experimental Problems.** (1), (2), or (3)

108f or w. **Abnormal Psychology.** The abnormalities of mental life resulting from inborn, pathological, or artificial causes (such as idiocy, aphasia, apraxia, somnambulism, hypnosis, etc.) and their educational, medical, and forensic significance. (3) Mr. ———.

150sp. **Thinking.** The physiological laws underlying human thinking, especially the traditional forms of the syllogism. (1) Mr. ———.

151sm. **Association.** Many experiments on learning in animal and human subjects will be examined, and the data obtained will be applied in constructing a theory of association. Mr. ———.

160sm. **Vision.** A careful study of a number of vertebrate eyes, a critical review of a number of theories of color vision, and a careful consideration of optical illusions and stereoscopic figures. Mr. ———.

209f or w. **Psychological Systems.** A comparative study of the psychological systems as found in the chief text-books on psychology issued during the last thirty years. (4) Mr. ———.

PHILOSOPHY

103f. **Ethical Theory.** Prerequisite, sophomore standing. An introductory study of the main problems of ethics and of the chief methods of their solution, with constant reference to the principal historic schools for illustration and interpretation. (3) Mr. HUDSON.

104f and 104sp. **History of Ancient and Medieval Philosophy from the Ionian Schools to Bacon.** Prerequisite, sophomore standing. (3) Mr. HUDSON.

105w and 105sm. **History of Modern Philosophy from the Renaissance to the 19th Century.** Prerequisite, sophomore standing. Properly follows course 104f or 104sp, though this is not required. The development of modern systems and their relations to science and to political and social movements. (3) Mr. SABINE.

108f. **Philosophical Aspects of Evolution.** Prerequisite, sophomore standing. The origin of the theory of evolution, its application outside biology, particularly in ethical theory, and its meaning and value for metaphysics. (2) Mr. SABINE.

111w. **Philosophy of the State.** Prerequisite, junior standing. An historical and critical survey of theories of political obligation and political liberty. (3) Mr. SABINE.

112w. **American Ideals.** Prerequisite, junior standing. A study of the metaphysical and ethical interpretations of life implied in American social and political institutions of the present day. (3) Mr. HUDSON.

121w. **Current Philosophical Problems.** Prerequisite, course 105w or 105sm or an equivalent. Representative systems, issues and controversies of the present day; general relations to historic philosophies. Stress is laid upon the problems and tendencies characteristically modern in their setting, such as those aroused by the development of modern science. (3) Mr. HUDSON.

230f and 230w. **Seminary.** Subject to be determined. Two or three hours' credit according to the amount of work done. Mr. HUDSON; Mr. SABINE.

GROUP OF EDUCATION

102f, w, sp, and sm. **Educational Psychology.** Prerequisite, experimental psychology 1 or 10. An introduction to the science of education. An application of the methods and results of experimental psychology to the problem of training children. (3) Mr. PYLE.

110f, w, and sp. **The Psychology of Learning.** Prerequisite, an approved course in general psychology, and course 102 or its equivalent. Undertakes to work out a science of education based upon a knowledge of the child and the laws of learning. A part of the course will consist in a study of the period of adolescence. 110f, lectures, textbook, and laboratory; 110w, laboratory only. (Credit to be arranged.) Mr. PYLE.

111w and sm. **Psychological Tests.** A laboratory course in mental and physical tests, the psychology of individual differences, and the economy and technique of learning. (3) Mr. PYLE.

112f and sm. **Abnormal and Defective Children.** A study of subnormal and supernormal children from the standpoint of genetic psychology. Examination of the causes of these deviations, tests for their determination, and a study of their proper treatment. (1) Mr. PYLE.

113f and sp and 114w. **Current Problems.** A study of current problems in education from the point of view of psychology. Informal discussions and reports of periodical literature in educational psychology. May be elected in successive years. (1) Mr. PYLE.

118sm. **History of Education in Ancient and Mediaeval Times.** (2) Mr. COURSAULT.

119sm. **History of Education in Modern Times.** (2) Mr. COURSAULT.

120f and w. **History of Education.** A general course combining courses 118 and 119. (4) Mr. COURSAULT.

121f and sm. **Educational Classics.** An intensive study of the historical setting and content of a few educational classics which mark prominent movements in the development of educational thought and practice. (3) Mr. COURSAULT.

148w and sp. **Teaching of Education.** This course deals with the problems of teacher-training in the high school. (2) Mr. OPPENHEIMER.

153f. **Social Problems in Public Schools.** (3) Mr. OPPENHEIMER.

154f, w, and sp. **Experimental Studies in Classroom Methods.** (1) (2) (3) Mr. MERIAM.

155f and sp. **Supervision—Teaching and Studying.** (3) Mr. MERIAM; Mr. WATKINS.

156f. **School Supervision.** Arranged for superintendents, principals, and supervisors. Laboratory work in the University schools. (2) or (3) Mr. MERIAM.

157 w and sm. **Supervision—Schoolroom Tests and Educational Measurements.** (3) Mr. MERIAM; Mr. OPPENHEIMER.

162w and sm. **School Administration.** The third hour of credit given for individual practice work in investigation and solution of practical problems involved in the administration of the University High School and Columbia public schools. Twice a week. (2) or (3) Mr. ELLIFF.

163w and sm. **High School Administration.** Prerequisite, courses 102 and 120 or equivalent. (3) Mr. ELLIFF.

164w and sp. **Administration of Art Education.** Intended to acquaint superintendents and supervisors with the working details of art education from the administrative standpoint. No previous credit in art a prerequisite. (1) Mr. ANKENY.

165f. **Organization and Administration of Manual Arts.** Development of manual arts in the United States; the organization of work in different grades; courses of study; supplies, plans and cost of equipment in elementary and secondary schools; maintenance and problems of administration. (2) Mr. ———.

167f. **Organization and Administration of Vocational Home Economics.** A brief survey of the vocational movement as applied to Home Economics. A study will be made of the provisions of

the Smith-Hughes Act and of some typical vocational schools. (1) Miss STANLEY.

168f and sm. **Organization and Administration of Vocational Education.** (2) Mr. ———.

169w and sm. **Organization and Administration of Industrial Education.** (2) Mr. ———.

170w and sm. **Principles of Education.** (w, 3); (sm, 2½) Mr. COURSAULT.

174w. **General Science in Public Schools..** (2) Mr. WATKINS.

175sm. **High School Problems.** (2½) Mr. ELLIFF.

176sp. **The Junior High School.** (3) Mr. OPPENHEIMER.

210f, sp, and sm, and 211w. **Seminary in Educational Psychology.** Open only to students who have had considerable training in both education and psychology. For thesis work. Credit to be arranged. Mr. PYLE; Mr. ———.

215f, sp, and sm, and 216w. **Research in Educational Psychology.** Open only to students who have had considerable training in both general and educational psychology, including training in psychological method. Original investigation of problems in any field of educational psychology. Credit to be arranged. Mr. PYLE; Mr. ———.

220f and sm, and 221w. **Seminary in History of Education.** Thesis work for graduate degrees. Credit to be arranged. Mr. COURSAULT.

232w and s. **Problems in the Teaching of Art in Secondary Schools and Colleges.** Opportunity will be given the student to conduct original investigation. (2) or (5) Mr. ANKENY.

250f and sp, and 251w and sm. **Seminary in School Supervision and Theory of Teaching.** Problems and thesis work for graduate degrees. Opportunity is offered for experimental work in the University schools. Credit to be arranged. Mr. MERIAM.

255sp. **Public School Curriculum—Social Problems in the Public schools.** (2½). Mr. ———.

256sm. **Public School Curriculum—Educational Measurements.** (2½) Mr. MERIAM.

255f and sp, and 256w. **Public School Curriculum.** Research work in courses of study for elementary schools and for high schools. Statistical studies of results of school work are included. (3) Mr. MERIAM.

260w and sm. **Seminary in School Administration.** Prerequisite, course 161 or 163. May be taken in connection with thesis work for graduate degree. Credit to be arranged. Mr. ELLIFF.

268f and sp, and 269w. **Seminary in Philosophy of Education.** Thesis work for graduate degrees. Credit to be arranged. Mr. COURSAULT.

271f and 272w. **Philosophy of Education.** A study of the fundamentals of education in the light of modern science and philosophy. (3) Mr. COURSAULT.

273sm. **Types of Educational Theory.** (1½) Mr. COURSAULT.

GROUP OF HISTORY AND POLITICAL SCIENCE

ECONOMICS

105f and w. **Money, Credit and Banking.** A study of the relation of the production of the precious metals and the banking business to the supply of money and the prices of commodities. (5) Mr. ROGERS.

105sp. **Money, Credit and Banking.** (3½) Mr. ROGERS.

106f. **Transportation.** The theory of rate making, competition of transportation lines, transportation monopoly, discriminations and their effects, and rate regulation. Particular attention is devoted to leading decisions of the Interstate Commerce Commission. (2) Mr. BROWN.

107sm. **Economic History of the United States.** Influence of economic factors in the development of the United States. (2½) Mr. WOOSTER.

110w. **Labor Problems.** A critical study of labor conditions and of the various means of improving them. (5) Mr. WOOSTER.

112sp. **Labor Movements.** Prerequisite, Economics 110; may be taken without prerequisite by special consent of the instructor. A survey and critique of socialism, anarchism, bolshevism, syndicalism, and the I. W. W. (2½) Mr. WOOSTER..

115w. **Public Revenues.** A study of the finances and financial methods of governments, with special reference to taxation. (5) Mr. BROWN.

117w. **Advanced Accounting.** An intensive study of the balance sheet and income statement; a detailed study of cost accounts and of special problems in partnership, corporate, and estate accounting. (4) Mr. SCOTT.

118f and sp. **Corporation Finance.** Describes the purposes and methods pursued in the organization and management of business corporations and the uses and character of corporation securities as related to the investors and to the corporation's management. (3f) (2½sp) Mr. ROGERS.

119w. **Trusts and Combinations.** The development of business organizations, the financing of such enterprises, their relations to the control of industry, the prices of commodities, and the distribution of wealth. (2) Mr. WATKINS.

120w. **Speculative Markets and Business Cycles.** The organization, methods, and functions of produce exchanges and securities markets and the influence of their operations upon the movements of

prices. The recurring periods of activity and inactivity in business known as prosperity, crisis, and depression, and their relation to speculative and investment transactions. (3) Mr. ROGERS.

121f. **Accounting and Business Policy.** A comparative study and interpretation of accounting methods; an examination of the relations of accounting to business policies. (2) Mr. SCOTT.

122w. **Investments.** A study of the forms of investments—stocks, bonds and mortgages—in regard to their suitability for the different types of investors. (2) Mr. ROGERS.

124w. **Foreign Exchange and Trade.** (a) The principles and practice of foreign exchange; (b) analysis of principles underlying foreign trade; (c) shipping, finance, and sales problems. (2) Mr. BROWN.

128f. **Statistics and Business Problems.** A study of the use of statistics for the purpose of the direction of business policy. (2) Mr. SCOTT.

132w. **Banking Practice.** Prerequisite, course 105. Deals with problems confronting the cashier—passing upon validity and security of notes, drafts, etc.; the construction and use of accounting devices for keeping him continuously informed about every operation which might influence his loan policy; etc. (2) Mr. WATKINS.

134f. **Public Accounting and Auditing.** The organization of accounts, state, county, and municipal; accounts of public service corporations under both public and private operation. (2) Mr. SCOTT.

136w. **Employment Problems.** A critical study of methods and systems of hiring and handling employees in various lines of industry. Problems of employment and organization are studied from the employer's point of view. (2) Mr. WOOSTER.

137f. **Factory Management.** Covers the problems connected with building and equipping a manufacturing plant, as well as those connected with its internal administration. (2) Mr. WATKINS.

138w. **Mercantile Organization and Credits.** A study of the administration of the relations of a business enterprise with outside parties—current creditors, customers, etc. (3) Mr. WATKINS.

140f. **History of Commerce and Industry.** This course is built around a study of the development of markets. The evolution in the forms of market organization will be analyzed, particularly in relation to changes in industrial processes but also in relation to changes in political and social institutions. (2) Mr. WATKINS.

150f and sm. **Business Law.** The emphasis of this course is chiefly upon the law of contracts and sales; attention is also given to the law of agency, of bailments, and negotiable instruments. (3) Mr. WATKINS; Mr. ———.

210w. **Theory of Income.** Not given in 1919-20. The economic laws which determine the shares from industry and a classification of incomes from the viewpoint of justice. (3) Mr. BROWN.

211f. **Advanced Economic Theory.** A critical examination of the writings of the leading economists from the time of Adam Smith to the present, to the end of constructing a correct theory of value and distribution. A survey of the theoretical aspects of the science. (5) Mr. BROWN.

212f and 213w. **Seminaries.** Credit to be arranged. Mr. BROWN; Mr. WOOSTER; Mr. ROGERS.

HISTORY

110w. **The Renaissance.** Cultural history, 1300-1500. (2) Mr. TRENHOLME.

112f. **Economic and Social History of Mediaeval Europe.** (2) Mr. WRENCH.

113w. **Economic and Social History of Modern Europe.** (2) Mr. KERNER.

115f and w. **Recent European History, 1815 to present.** (5) Mr. KERNER.

117f. **English History.** (5) Mr. TRENHOLME.

131w. **Oriental History, 600 A. D. to present.** (3) Mr. WRENCH.

150sp. **European Culture and Civilization. The Middle Ages.** (2) Mr. WRENCH.

163w. **Modern Germany and Austria-Hungary.** (2) Mr. KERNER.

175w. **American Constitutional History.** (3) Mr. STEPHENS.

180f. **American Industrial and Social History.** (3) Mr. STEPHENS.

182f. **History of the West.** (3) Mr. VILES.

184sp. **History of the South.** (2) Mr. STEPHENS.

190w. **American Diplomatic History.** (3) Mr. STEPHENS.

192w. **Political Parties in the United States.** (3) Mr. VILES.

195sm. **Recent United States History.** (3) Mr. VILES.

207f and w. **Recent English History.** (2) or (3) Mr. TRENHOLME.

210f, w, and s. **Seminary in Historical Research and Thesis Work.** (1) (2) (3) or (4) Mr. TRENHOLME; Mr. VILES; Mr. STEPHENS; Mr. WRENCH; Mr. KERNER.

225f, w, and s. **Seminary in Missouri History.** (3) Mr. VILES; Mr. STEPHENS.

POLITICAL SCIENCE AND PUBLIC LAW

104f. **European Governments.** A descriptive study of the constitutional organization and practical working of the principal govern-

ments of Europe, with considerable attention to political parties and current political questions. (5) Mr. SHEPARD.

105w. **Comparative Constitutional Law.** A comparative study of the legal and theoretical basis of the modern state, the various forms of government, and the structure and function of the principal governmental organs. (3) Mr. SHEPARD.

106f and sp. **Municipal Government.** A study of the organization of the cities of the United States. During the latter part of the course special topics will be taken up in more detail, such as: central control over cities, municipal elections, municipal revenue, the regulation of public utilities, and municipal ownership. (2) Mr. LOEB.

107sp. **Party Government.** A study of the theory, organization, methods of action, and functions of political parties, with special emphasis on the party system of the United States. (2) Mr. ———.

108w. **State Administration.** A study of the development, organization, and functions of the executive branch of the American state governments, with special emphasis on the newer administrative agencies and the relation of the state government to contemporary economic and social problems. (3) Mr. LOEB.

109w. **International Law.** A general treatment of the law governing international relations in peace and war, with considerable attention to the problems arising out of the European War. (3) Mr. SHEPARD.

112sm. **Federal Administration.** A study of public administration as practiced in the departments, commissions, and bureaus under the President. (2) Mr. ———.

120w. **Problems in Municipal Administration.** A detailed study of certain specific problems in the administration of cities. (2) Mr. ———.

201sp. **Administrative Law.** A study of the legal principles regulating the acts of administrative officers of the national and commonwealth governments. (3) Mr. ———.

204f and 205w. **Constitutional Law of the United States.** Particular attention will be given to the field of individual liberty defined in the Constitution of the United States and interpreted in the decisions of the Supreme Court. (3) and (2) Mr. LOEB.

210f. **History of Political Theories to the French Revolution.** A study of the development of political thought in its relation, as cause and effect, to political action, from the period of antiquity to the French Revolution. (2) Mr. SHEPARD.

211w. **Recent and Contemporary Political Theories.** A study of political theory since the French Revolution and its influences upon political action. (2) Mr. SHEPARD.

212w. **Proseminary.** (3) Mr. SHEPARD.

220f, 221w, 222sp, and 223sm. **Seminary.** Credit to be arranged. Mr. LOEB; Mr. SHEPARD.

SOCIOLOGY

110f and sm. **Social Pathology.** A study of the pathological or abnormal factors and classes in society; a consideration of the causes, prevalence, and significance of poverty; the treatment of dependent and degenerate classes; institutional and state administration of charity. (f3) Mr. TAYLOR. (sm 2½) Mr. ———

111w. **Criminology.** Prerequisite, course 1. The nature and causes of crime; the criminal and the juvenile delinquent; penal, reformatory, and preventive methods; the indeterminate sentence, probation, and parole; the reform of criminal procedure; police methods. (3) Mr. TAYLOR.

112f. **Preventive Philanthropy and Constructive Social Policies.** An intensive study of some specific problems in preventive work, including considerable time given to child welfare, playgrounds, child labor, compulsory education, and juvenile court work; a more general consideration of the theories and legislation dealing with such problems as eugenics, the woman's movement, compensation and social insurance, public health and sanitation. (2) Mr. TAYLOR.

115f and sp. **Rural Sociology.** A study of social conditions in rural communities and their improvement. Fifteen or twenty definite rural social problems, such as the drift to the cities, farming as an occupation, land problems, farm labor problems, cooperation, the rural school, the rural church, rural health and sanitation, the rural home, the social center. (2) Mr. TAYLOR. (sp. 2½) Mr. ———.

116w. **Urban Sociology.** A study of social conditions in urban communities and their improvement. A few of the problems taken up are the history and growth of urban communities, city planning, housing, traffic and transportation, health and sanitation, city maladjustments, administration of public utilities. (2) Mr. TAYLOR.

125f. **General Anthropology.** A study of the origin and evolution of man as an animal and of the different races of mankind. The prehistoric human types, the principles of ethnology, and the characteristics of the Negro, Mongolian, American, and Caucasian races. Lectures and assigned reading. (3) Mr. ELLWOOD.

126w. **Cultural Anthropology.** A study of social origins and of the earliest stages of cultural evolution; the stone and metal ages, the origins of industry, language, magic, religion, morals, science, art, and of social organization in the family, horde, clan, and tribe. Lectures and assigned reading. (3) Mr. ELLWOOD.

220f. **The Principles of Sociology.** A critical study of sociological theory. The sociological theories of recent writers will be critically examined with a view to laying the foundations for a constructive theory of the social life in modern biology and psychology. Discussions and papers by the class. (3) Mr. ELLWOOD.

221w. **Biological Factors in Social Evolution.** A course on the biological basis of sociology. Among the topics treated will be the relation of organic to social evolution with special attention to heredity, selection, adaptation, and variation, the beginnings of social evolution in the animal world, and the instinctive, emotional, and intellectual bases of association. Lectures, assigned reading, and research work. (2) Mr. ELLWOOD.

222w. **Methods of Social Investigation and Research.** A study of the various methods of social research and investigation, including statistics and other social measurements. Social surveying, its technique and technology, is taught and students are assigned definite problems for field practice in investigation. (2) Mr. TAYLOR.

227sp. **The American Negro.** A study of Negro problems in America; the social, economic, moral and educational status of the Negro population; the psychology of the color line, racial consciousness, and other facts of psychic and social nature will be given consideration. (1) Mr. ———.

230w. **History of Social Philosophy.** Lectures on the development of social thought from Aristotle to the present; the social philosophies of Plato, Aristotle, St. Augustine, Thomas Aquinas, Machiavelli, Bodin, Hobbes, Locke, Vico, Montesquieu, Rousseau, Condorcet, and the sociological systems of Comte, Spencer, Shaeffle, Lilienfeldt, Gumpłowicz, Ratzenhofer, and Ward will, among others, be considered. A large amount of assigned reading will be required in this course. The student is advised to correlate this course with related courses in economics, history, political science, and philosophy. (3) Mr. ELLWOOD.

231w. **History of Philanthropy and the Poor Law.** Not given in 1919-20. A study of the development of legislation governing and methods of administering public relief in England and America, and the parallel account of voluntary charitable institutions and methods. (2)

240f, w and s. **Seminary.** Research work upon special problems in sociology and philanthropy. Two, three, or four hours' credit will be given, according to the amount of work. Mr. ELLWOOD; Mr. TAYLOR.

SCHOOL OF SOCIAL ECONOMY

A training School for Social Workers. Located in St. Louis.

101f. **Problems of Poverty.** This course deals with the causes of poverty and considers at length the individual and social factors involved. It includes a discussion of the remedial agencies, both public and private, and outlines their general sphere of effort. Special attention is given to the improvement of living and working conditions and the development of better physical and mental types. (3) Miss McCLENAHAN.

102f. **Labor Problems.** A review of the social effects of the industrial revolution and of the rise of the factory system. A study of labor supply, wages, hours of labor, unemployment, labor organization, the sweating system, woman labor, minimum wage, standards and cost of living, workmen's compensation, factory inspection, and methods of promoting the amelioration of the wage-earning classes. (3) Mr. MANGOLD.

103f and 104w. **Practice of Organized Charity.** During the first term the course deals with the problems of the social reconstruction of individuals or families. The general principles and processes of social treatment are discussed and students are familiarized with the recognized methods of dealing with broken or depressed families. In the second term a study is made of the methods of organizations specializing in particular case problems. This course provides the fundamentals for the practical training in case work. (3) Miss WILDER.

105w. **Neighborhood and Group Work.** A course designed to train students for effective work in handling groups in settlements, in social centers, and in the welfare departments of stores and factories. The principles and methods underlying such work are studied and practical activities are required of the students. (3) Miss McCLENAHAN.

106w. **Community Organization.** This course includes a study of the social survey, the reasons for the survey and the methods of making a survey. It leads into a study of the social problems and social resources of the rural district, village, town, and city under 50,000. The study of the survey and of the problems and resources of different types of communities gives the basis for an analysis of various plans for community organization, including the organization of all social welfare agencies with the county as the unit. (3) Miss McCLENAHAN.

108f. **Crime and Its Treatment.** This course embraces a discussion of the physical and social causes of crime, the various schools of criminology, the police, the criminal courts, court procedure, jails, reformatories and penal systems, indeterminate sentence, adult probation, the cost of crime, and measures of prosecution. Special problems of the woman offender are considered. (2) Mr. MANGOLD.

109w. **Child Welfare.** This course begins with the study of heredity and environment as social factors. Then the problems of infant and child mortality, protection from disease, the playground movement, and the social aspects of education, including truancy, retardation, and industrial training are briefly discussed. Attention is given to child labor problems, juvenile delinquency, the probation system, reformatory institutions, measures of child protection, the dependent and neglected child, and child caring agencies, public and private. (3) Mr. MANGOLD.

111w. **Race Problems.** The course deals with the problems of immigration and discusses sources, social, economic, and political ef-

fects, methods of assimilation, immigration legislation, and effect on national character. A program of the work by public and private agencies to promote the Americanization of the immigrant is reviewed and a program of betterment is outlined. (3) Miss WILDER.

112w. **Race Problems.** A brief study is made of the negro, with special reference to St. Louis. The economic, social, and educational problems are considered. (1) Miss WILDER.

113f. **Social Activities of Cities.** The object of this course is to familiarize the student with those branches of municipal government that deal with the social problems of the city, to analyze their operations, to understand their scope and purpose, and to relate their activities to those of the private agencies in the community. Special attention is given to cities that have developed departments of social welfare. The effect and value of improvements in governmental machinery are also discussed. (3) Mr. MANGOLD.

114w. **Problems of Social Reconstruction.** This course aims to bring to the attention of the student some of the many problems growing out of the war, such as the care of the families of soldiers and sailors, unemployment, rehabilitation of the wounded, industrial re-adjustment, cost of living, Americanization, and the promotion of democracy. A study is also made of the recent developments in the control of social disease and of tuberculosis, in community service, and in the socialization of education and of religion. (3) Mr. MANGOLD.

204f and 205w. **Methods of Social Research.** Courses dealing with the principles and practice of social investigations, with practical work on a number of selected problems. The methods of inquiry used by state, federal, and private agencies are studied, and the value and validity of selected reports examined. Direct information is gained in regard to wages, cost of living, movement of population, birth rate, marriage and divorce, and other problems. (3) Mr. MANGOLD; Miss WILDER.

212w. **Organization and Function of Social Agencies.** A discussion of the functions and actual work of typical agencies such as charity organization, anti-tuberculosis, children's aid, public health, and county welfare societies. Methods of cooperation thru central council or federation, bases for a division of the field, problems of extension of service, and related questions are considered. (3) Mr. MANGOLD.

215f and w. **Seminary.** Research courses for special investigations and thesis work. (2-4) Mr. MANGOLD.

In addition to the above courses, practice work is required of every candidate for a degree.

GROUP OF MATHEMATICAL AND PHYSICAL SCIENCES
ASTRONOMY

106f or w. **Advanced Astronomy.** Subjects are selected to meet the requirements of the individual students. Credit to be arranged. Mr. BAKER.

220f or w. **Research.** Opportunity for original investigation is offered to qualified students. Credit to be arranged.

CHEMISTRY

110f and w. **Organic Chemistry.** Prerequisite, ten hours' work in chemistry; medical students will be admitted to this course with eight hours' chemistry. (5) Mr. CALVERT.

112w. **Organic Chemistry.** Completion of the subject matter of course 110. Recommended to students specializing in chemistry. (3) Mr. CALVERT.

113f and w. **Organic Synthesis and Analysis.** A laboratory course in synthetic organic chemistry. May be taken with course 15 or 110. (3) (4) or (5) Mr. CALVERT.

121f and w. **Quantitative Chemical Analysis.** Prerequisite, course 27. The general principles. (5) Mr. BROWN; Mr. GIBSON.

122f and w. **Quantitative Chemical Analysis.** Prerequisite, course 121. The analysis of commercial materials and products. (5) Mr. BROWN; Mr. GIBSON.

125w. **Quantitative Organic Analysis.** Must be preceded or accompanied by course 121. Quantitative analysis of commercial organic products. (5) Mr. CALVERT.

131f. **Physical Chemistry.** Prerequisite, a college course in physics, three hours of quantitative analysis, and three hours of organic chemistry. (5) Miss DOVER; Mr. MARDEN.

133w. **Electro-Chemistry.** Prerequisite, same as 131. (5) Mr. MARDEN.

135w. **Radioactivity.** Prerequisite, undergraduate courses in physics and chemistry. (3) Mr. SCHLUNDT.

141f. **Industrial Inorganic Chemistry.** Prerequisite, courses 7 and 110. (3) (4) or (5) Mr. BROWN; Mr. ———.

142w. **Industrial Organic Chemistry.** Prerequisite, same as for course 141. (2) or (3) Mr. BROWN; Mr. ———.

201w. **Advanced Inorganic Chemistry.** Not given in 1919-20. Must be preceded or accompanied by 131. Lectures and recitations. (3) Mr. MARDEN.

211f. **Advanced Organic Chemistry.** Prerequisite, course 110. Lectures on selected topics, supplemented by reading and reports. In the selection of the subjects the special needs of the students will be considered. (3) Mr. CALVERT.

227w. **Advanced Analytical Chemistry.** Prerequisite, course 121. Chiefly laboratory work. The work of the course is varied to meet the needs of the individual. Credit to be arranged. Mr. BROWN; Mr. GIBSON.

232w. **Advanced Physical Chemistry.** Not given in 1919-20. Prerequisite, courses 131 and 121. Lectures on selected topics. A reading knowledge of German and French is very desirable. Credit to be arranged. Mr. SCHLUNDT.

260f and 261w. **Seminary.** Meetings at which subjects of a chemical interest are discussed by students of sufficient attainment and members of the teaching staff. A reading knowledge of French and German is desirable. (1)

271f, w and s. **Research.** Arrangements for research should be made by consultation with the professor or instructor with whom the research is elected.

The University of Missouri Section of the American Chemical Society meets monthly. Students may attend these meetings.

GEOLOGY

110f. **Economic Geology.** Prerequisite, course 1 or 2. Deals with coal, oil and gas, clays, building stones, cement materials, gypsum, fertilizers, and various minor products; their geographic distribution, mode of occurrence, uses, origin, and conservation. The department has a good collection of these products which are studied in the laboratory. Field trips to mines and quarries near Columbia. (2) Mr. TARR.

101w. **Economic Geology.** Prerequisite, course 1 or 2, and elementary chemistry. Considers deposits of gold, silver, copper, iron, zinc, aluminum, and minor metals; their geographic distribution, mode of occurrence, origin, uses, production, and conservation. (2) Mr. TARR.

102w. **Advanced Physiography.** Prerequisite, course 1 or 2. Deals with earth features and their origin. Topographic maps are used extensively. (3-5) Mr. BRATTON.

104w. **Rocks and Rock Minerals.** Prerequisite, course 1 or 2. A study of the various kinds of common rocks and of the minerals that constitute them. A field classification is followed in the laboratory and the methods pursued are those which would be used in the field. The lectures deal with the origin, geologic features, economic properties, and weathering of rocks. Designed for those who wish a general knowledge of rocks as well as for geologists, engineers, architects, agriculturists. (3) Mr. TARR.

105sp and sm. **Field course.** Prerequisite, 5 hours of geology. Intended as preparatory for advanced work in geology and as a basis for the teaching of geology and physical geography. The field work consists of mapping the areal geology, describing the sedimentary forma-

tions, igneous and metamorphic rocks, collecting in a systematic way from the formations, and reporting on the structural geology, physiography, and economic products of a small area in Colorado or Wyoming. Special topics are assigned to graduate students, and this work may form the basis for masters' or doctors' theses. (8) Mr. TARR (1919); Mr. BRANSON (1920).

106f. **Mineralogy.** Prerequisite, course 1 or 2. The elements of crystallography, lectures and work with models and crystals. Physical and chemical properties, distribution and uses of minerals. (3) Mr. TARR.

107f. **Determinative Mineralogy.** Prerequisite, course 106f. Laboratory work. Preliminary studies of the common elements, followed by the determination of unknown minerals. (3) Mr. TARR.

120f. **Historical Geology of the Paleozoic.** Prerequisite, course 1. Principles of sedimentation; distribution and kinds of rocks of each geologic period of the paleozoic; geographic changes of the North American continent; causes for geographic changes; climate of each period. Several field trips. (3) Mr. BRANSON.

121w. **Historical Geology of the Mesozoic and Cenozoic.** Considers the mesozoic and cenozoic as 120f considers the paleozoic. (3) Mr. BRANSON.

125f. **Life of the Paleozoic.** Prerequisite, course 1, and a course in zoology. Changes that took place in the life of the earth from its first appearance to the close of the paleozoic and the causes for these changes. The life of each geologic period is considered as a whole and in its relation to the life of the preceding and following periods. In the laboratory, students examine specimens that illustrate the gradual evolution toward living types. (2) Mr. BRANSON.

126w. **Life of the Mesozoic and Cenozoic.** A companion course for 125f. Treats of the life of the mesozoic and cenozoic. (2) Mr. BRANSON.

130f. **Petrology.** Prerequisite, courses 104w, 106f, 107f, 108w, 109w, inorganic chemistry, and general physics. Principles of optics as applied to the polarizing microscope, optical properties of the rock-forming minerals, microscopic and megascopic study of the various rock groups. (5) Mr. CONOLLY.

200w. **Geology of Oils and Gas.** Prerequisite, courses 100f, 104w, 120f, and 121w. Occurrence, origin, and methods of accumulation of oil and gas; location of wells; development of oil and gas properties; oil and gas fields of North America. (3), (4) or (5) Mr. TARR.

201f. **Principles of Ore Deposits.** Prerequisite, courses 101w, 104w, 106f, 107f, 108w. A detailed study of the occurrence, origin, and alterations of ore deposits. (3) Mr. TARR.

202f and w. **Stratigraphy and Paleontology.** (3), (4) or (5) Mr. BRANSON.

204f and 205w. **Seminary.** Geological literature and history. (1) or (2) Mr. BRANSON; Mr. TARR.

207w. **Advanced Mineralogy.** Prerequisite, courses 104w, 106f, and 107f. The occurrence, origin, alteration, classification, and geologic significance of minerals. (2) Mr. TARR.

208w. **Advanced Determinative Mineralogy.** Prerequisite, course 107f. Continuation of 107f. Laboratory includes work in the paragenesis of minerals, pseudomorphism, etc. (2) Mr. TARR.

220f, w, and s. **Research.** Offered by members of the department in their respective lines.

GEOGRAPHY

108sm. **Geography of Missouri.** Topography, climate, and natural resources of Missouri; their influences on settlement, development, and localization of industries. (2) Mr. BRANSON.

110w. **Geography of North America.** Prerequisite, fifty hours of college credit or course 1 or 6. Physiographic provinces, climatic regions, plant regions, mineral resources, localization and development of industries; their influence on the distribution of population, growth of cities, and historic development of the North American countries. (3) Mr. BRATTON.

111f. **Geography of South America.** Prerequisite, fifty hours of college credit, or course 1 or 6. Physiographic provinces, climate, natural resources, historical background; their influence on distribution of population, economic development, and trade relations. (3) Mr. BRATTON.

112s. **Geography of Europe.** Prerequisite, fifty hours of college credit or course 1 or 6. Effects of location of the continent; physiographic provinces, climatic regions, plant regions, natural resources; influences of these on distribution of population, transportation, local and foreign trade, and local industrial conditions. (3) Mr. BRATTON.

115w. **Advanced Commerical Geography.** Food producing, raw material producing, and manufacturing regions of the world; relation between population and character of products; methods of trade and trade routes. (3) Mr. BRATTON.

215f, w, and s. **Seminary: Geographic Literature.** A reading course for students capable of doing semi-independent work. Subjects: pedagogical, regional, economic, historical. (2-5) Mr. BRATTON.

230f, w, and s. **Research.**

MATHEMATICS

It is especially recommended that students intending to specialize in mathematics should take courses in French and German in the preliminary work; but an extensive knowledge of the literature of those languages is not necessary.

Before electing any of these courses, the student should consult the instructor. Except where noted, the calculus is a prerequisite.

Courses 100 and 101 are prerequisite to all courses above 200 except 251.

100f and sp, and 101w and sm. **Second Course in Calculus.** This course should be taken by all wishing to specialize in mathematics. (3) Mr. HEDRICK.

105f. **Advanced Algebra.** Prerequisite, courses 2 and 4. This course will include determinants, theory of equations, and applications of algebra to geometry. (3) Mr. INGOLD.

110f. **The Historical Development of Mathematics.** (3) Mr. AMES.

120f and 125w. **Differential Equations and Their Applications.** Not offered in 1919-20. (3) Mr. INGOLD.

130f. **Applications of Analysis.** A study of the differential equations, the series, and the integrals most essential to the mathematical sciences. (3) Mr. KELLOGG.

155w. **Mathematics of Business and Insurance.** Prerequisite, course 1 or its equivalent. (3) Mr. WESTFALL.

160f. **Probabilities and Statistics.** Prerequisite, course 1 or its equivalent. (3) Mr. WESTFALL.

200f, w, and s. **Seminary.** The members of the staff will conduct work in reading and research in private with students prepared for such work. The nature and amount of the work done may vary materially. The course may be elected repeatedly in different semesters for different work and for any number of hours sanctioned by the instructor.

The following courses will be given in alternate years:

220w. **Fourier's Series and Allied Series.** (3) Mr. KELLOGG.

225w. **Potential Functions.** Not offered in 1919-20. (3) Mr. KELLOGG.

230f and 231w. **Theory of Functions of Real Variables.** (3) Mr. HEDRICK.

240f and 241w. **Theory of Functions of Complex Variables.** Not offered 1919-20. (3) Mr. HEDRICK.

The following courses are offered from time to time, but not necessarily every year.

210f or w. **Differential Geometry.** (3) Mr. INGOLD.

215w. **Projective Geometry.** (3) Mr. INGOLD.

280f or w. **Calculus of Variations.** (3) Mr. WESTFALL.

251f and w. **Seminary in Actuarial and Other Statistical Problems.** (3) Mr. WESTFALL.

Mathematical Club. The students of the department conduct, for the discussion of mathematical topics, a club to which all persons interested are eligible. The members of the staff of the department hold regular meetings for the discussion of current literature and of recent research, which are open also to qualified graduate students.

PHYSICS

Students intending to specialize in physics should also take mathematics. Even in the less mathematical courses, some knowledge of calculus is of great advantage.

The following group of four courses constitute together a general course in advanced physics. It is recommended that students who have had the necessary preparation in mathematics elect 114 and 110 in their junior year, 112 and 113 in their senior year, though any one of the four may be chosen without the others. None of them include laboratory work, but students who desire advanced laboratory work in physics would do well to elect, along with these courses, the corresponding courses in the group 106, 107, 108. Physics 3 and 4, or their equivalent, are prerequisite for any of the following courses:

110sp. **Electricity and Magnetism.** This course is not mathematical in the same sense as course 207; still it contains some theoretical work. Lectures and recitations. (3)

112sm. **Heat.** (3)

113w. **Light.** (3) The work of these two courses is largely descriptive but contains some theoretical work in which an elementary knowledge of calculus is desirable though not essential. The course in heat includes some thermodynamics, one of the fundamental branches of physics.

114f. **Mechanics.** Calculus is prerequisite, unless it be taken concurrently. (3)

The following three courses consist entirely of laboratory work. Any one of them must be preceded either by courses 1 and 2 or by 3 and 4 or their equivalent. They offer training in the more exact methods of laboratory measurements:

106f. **Mechanics and Heat.** Not given in 1919-20. In mechanics, angular motion, acceleration of gravity, conservation of momentum, moment of inertia, elasticity, etc., are studied; in heat, such things as specific heats, heats of combustion, vapor densities, and different methods of measuring high and medium temperatures. Work in mechanics or in heat, or in both, may be selected to suit the individual needs of the student. (1) or (2)

107f and w. **Electricity.** This course is much the same as the laboratory work in course 104f. (1), (2) or (3)

108w. **Light.** Measurements of wave lengths by interference methods, determination of refractive indices, study of polarization and the resolving power of optical instruments, etc. (1) or (2)

109f and w. **Advanced Work in General Physics.** This course, largely laboratory work, will be adapted to meet the needs and attainments of individual students. A student may be assigned a definite problem, the literature of which must be studied and the experimental work performed with the care of original research. (1), (2), (3) or (4).

104f. **Electrical Measurements.** Two lectures and three laboratory periods. In the lectures is given an introduction to the mathematical theory of electricity and electrical measurements. The laboratory work consists of such work as comparisons of resistances by Kelvin double bridge and Carey Foster methods; determination of temperature coefficients; comparison of electromotive forces of cells; various uses of the potentiometer; comparison and absolute measurement of the coefficients of self and mutual induction; calibration of ammeters and voltmeters; photometric work with incandescent lamps. (3), (4) or (5)

121w. **Electrical Waves.** Theory and applications. (2) Mr. STEWART.

Courses 201, 202, 205, 206, 207 and 208 are courses in mathematical physics.

201f. **Thermodynamics.** Lectures on the classical theory, with applications to certain branches of physical chemistry and electricity. Prerequisite, two years of physics, and differential and integral calculus. (3) Mr. REESE.

202w. **Special Theoretical Problems.** Statistical mechanics, heat radiation, and related problems, with an introduction to the quantum theory. Prerequisite, two years of physics, and differential and integral calculus. Some preliminary acquaintance with differential equations and the more general principles of mechanics is also desirable. (3) Mr. REESE.

205f and 206w. **Theory of Light.** Prerequisite, calculus and two years' work in physics. Some attention is given to geometrical optics; the major part is devoted to the electromagnetic and electronic theories. Lectures and recitations. (3) Mr. STEWART.

207f and 208w. **Theory of Electricity and Magnetism.** Prerequisite, calculus and two years of physics; differential equations recommended. Fundamental concepts and vector equations of the electromagnetic field. Electron theory. Radiation. Relations between electricity and matter. Atomic theories. Lectures and recitations. (3) Mr. STEWART.

Courses 205-6 and 207-8 will not both be given in the same year.

209f and 210w. **Seminary.** Critical reading and discussion of current research work in physics. A colloquium in which all members of the teaching staff of the department and students of sufficient attainments take part. (1)

211f and w. **Research Work.** Hours to be arranged. Mr. STEWART; Mr. REESE.

GROUP OF BIOLOGICAL SCIENCES

ANATOMY

102f. **Gross Anatomy.** The study of the gross anatomy of the head and trunk of the human body, with the exception of the central nervous system. (9) Mr. CLARK; Mr. GAEBLER; Mr. MUIR.

103w. **Gross Anatomy.** The study of the gross anatomy of the extremities of the human body. (3) Mr. CLARK; Mr. GAEBLER; Mr. MUIR.

104f. **Histology.** The study of the microscopic anatomy of the tissues and organs of the human body. (5) Mr. ALBRITTON; Miss BROWN.

105w. **Neurology.** The study of the gross and microscopic anatomy of the central nervous system and sense organs. (3) Mr. CLARK; Miss BROWN.

106f or 106w. **Topographic Anatomy.** Prerequisite, course 102f. A study of the topography of the various organs with the aid of serial sections through the body. (2) or (3) Mr. CLARK.

107w. **Study-Room Course in Anatomy.** Prerequisite, course 102f. Each year dissected parts of the human body are preserved and are available for informal study. This may be combined with a study of cross sections. Mr. CLARK.

206f and 207w. **Advanced Anatomy.** Prerequisite, course 102f, 104w, or 105f. Advanced work will be given in any of the special fields of anatomy, the amount and character of which will be varied to suit individual needs. Mr. CLARK.

208f and 209w. **Research.** Problems of original investigation will be assigned in anatomy, histology, or embryology. Open to suitably prepared students. Mr. CLARK.

BOTANY

100w. **Plant Physiology.** Lectures and laboratory work on the physiology of the common cultivated plants, covering such topics as absorption, transpiration, synthesis of carbohydrates and proteins, digestion, translocation, respiration, growth, reproduction, and the reaction of plants to stimuli. (5) Mr. ———.

101w. **Ecology of Seed Plants.** Prerequisite, course 14b. The relation of plants to their environment, including a discussion of the origin, development, structure, and succession of plant formations. (2) Mr. MANEVAL.

102f. **Plant Pathology.** Courses 3f or w and 100 are desirable prerequisites. Life histories of important parasitic fungi and their pathological effects upon the host; isolation of parasites, technique of culture methods, and inoculation of the host. (3) Mr. ———.

103w. **Advanced Plant Pathology.** A continuation of the work as outlined under course 102f, which is prerequisite. Special emphasis on particular groups of diseases. (2) or (3) Mr. ———.

104f. **Histological Methods.** Methods used in the preparation and preservation of class material and in fixing, sectioning and staining of sections for microscopical study. (2) Mr. ———.

105f. **Comparative Morphology and Embryology.** Structure and life history of selected representatives of the great groups of green plants. Special attention will be given to tracing the development and homologies of sterile, sporogenous and reproductive parts, such as the formation of spores and gametes, fertilization, the development of the embryo. (3) Mr. ———.

106w. **Plant Breeding.** The study of the cell as the unit of structure and function, and as the physical basis of heredity. Particular emphasis upon the fundamental principles of plant breeding including hybridization, Mendelian phenomena, etc. (3) Mr. ———.

107w. **Problems in Plant Physiology.** Prerequisite, course 100f. Lectures and discussions on physiological problems. The work in any given term is confined to some special topic as mineral nutrients, photosynthesis, respiration, etc. Laboratory work on the subject considered may be elected for additional credit. (2-5) Mr. ———.

108w. **Diseases of Forest Trees.** Prerequisite, course 102f. Required of students in forestry. A study of the fungous diseases of forest trees, the fungi which cause decay in timber, and the methods of timber treatment. (3) Mr. ———.

111f and 112w. **Special Problems.** On consultation with the teachers concerned, properly prepared students may take up special problems in the various fields of botany. Credit to be arranged. Mr. MANEVAL.

200f and w. **Seminary.** Special subjects of botanical work will be taken up and discussed, including the results of investigations carried out in the department. A reading knowledge of French and German is essential. (1)

202f and 203w. **Research.** Students who have had adequate preparation will be assigned some special problem for investigation. A reading knowledge of French and German is essential. Credit and hours to be arranged. Mr. MANEVAL.

PATHOLOGY

201f and 202w. **Advanced Pathology.** The amount and character of the work will depend upon the needs and qualifications of the student. In connection, opportunity will be afforded for practical experience in the handling of all kinds of morbid material. Hours to be arranged. Mr. DOLLEY; Miss GUTHRIE.

203f, 204w, and 205sp. **Research.** Opportunity is offered to students sufficiently prepared for original investigation of unsolved problems in the fields of pathology and pathological physiology. A reading knowledge of German is required and French is recommended. A seminary is held once a week. Mr. DOLLEY.

206sp. **Pathological Physiology.** An experimental course. (2) Mr. DOLLEY; Miss GUTHRIE.

PHYSIOLOGY

101f. **General Physiological Chemistry.** Prerequisite, Chemistry, courses 110f or 110w, or equivalent. Physiological chemistry of the carbohydrates, fats, and proteins; of the cell and special tissues; of the blood; of respiration; of metabolism; of secretions and excretions; and a quantitative study of the urine in relation to diet. (4) Mr. GULICK; Mr. EWING.

102w. **General Physiological Chemistry.** The same as 101f, but the subjects handled more fully. (5) Mr. GULICK and an assistant.

103f. **Physiology of Alimentary Mechanism.** Secretion and reproduction. The physiology of secretory processes, digestive mechanics, absorption, excretion, respiration, metabolism and energy exchange, heat regulation, and reproduction. (2) Mr. GREENE; Mr. BUSH; Mr. MUCK.

105f. **Experimental Physiology.** The physiology of circulation, respiration, muscles and nerve, nervous system, and sense organs. (6) Mr. GREENE; Mr. BUSH; Mr. LOVE.

108w. **Pharmacology.** The physiological action of drugs from the experimental point of view. The demonstrations are made on man and the lower animals. (4) Mr. BUSH; Mr. GULICK.

115f and 116w. **Advanced Physiological Chemistry.** A course supplementing and extending course 101f. The preparation and chemistry of the proteins; a qualitative and quantitative study of the tissues and secretions, of enzymes, of putrefaction and putrefactive products; analyses of typical foods; and the detection of food preservations and adulterants. The prosecution of a short investigation and formal report on the same are required. (2-4) Mr. GULICK.

117f and 118w. **Toxicology.** Prerequisite, course 115f, 116w, or 108w. (2) or (3) Mr. GULICK.

109w. **Child Development and Growth.** Prerequisite, elementary physiology, 1f or 1w, or equivalent. A course of lectures and assigned reading, with special emphasis on factors that influence the capacities of the developing nervous system. (1) Mr. GREENE.

123f. **The Physiology and Pharmacology of the Circulatory System.** (3) Mr. GREENE.

226w. **The Physiology of the Nervous System.** (3) Mr. GREENE.

127f and 128w. **Journal Club.** (1) Mr. GREENE.

231f and 232w. **Advanced Physiology.** Elemental problems in physiology, physiological chemistry or pharmacology will be assigned in preparation for research. Mr. GREENE; Mr. GULICK.

241f and 242w. **Investigation.** Opportunity is offered for research into questions of current interest in either of the fields represented. Mr. GREENE; Mr. GULICK; Mr. BUSH.

PREVENTIVE MEDICINE AND BACTERIOLOGY

200f and w. **Advanced Bacteriology.** Prerequisite, course 102. Amount and character of work will depend on needs and qualifications of student. The manufacture of autogenous vaccines, the determination of the opsonic index, making and use of various sera, and the study of milk and water are among the subjects suggested. Hours to be arranged. Mr. RAVENEL.

201f and 202w. **Research.** Prerequisite, course 102f. Students who are sufficiently prepared will be given problems requiring original investigation in the fields of bacteriology and public health. A reading knowledge of French and German recommended. Hours to be arranged. Mr. RAVENEL.

203f and 204w. **Conduct of Public Health Laboratories.** Prerequisite, courses 102 and 200. Designed for those who expect to take up such work as a profession or for teaching purposes. Graduates in medicine preferred. The collection and shipment of various specimens, their examination, milk and water problems, etc., will be discussed and the practical work carried out in the laboratory. Hours to be arranged. Mr. RAVENEL.

205s. **Practical Hygiene.** A course designed for teachers in schools. It consists of lectures and demonstrations, the construction of simple apparatus, and the carrying out of simple experiments demonstrating the principles of modern hygiene. Mr. RAVENEL.

ZOOLOGY

101f and sp. **Embryology of Vertebrates.** Designed to lay the foundation of vertebrate embryology. Successive stages in the development of the frog, the chick and the pig are studied from preparations of entire embryos and from serial sections. These observations are used as a basis of comparison for the study of human embryology. (3) Mr. LEFEVRE; Mr. TANNREUTHER.

102f and sm. **Animal Ecology.** A course dealing with the principles of ecology and including a study of the structure, activities, life-histories, distribution, and evolution of animals. (3)

103w. **Cytology.** A study of the cell, with special reference to problems of development and inheritance. Cytological technique. (5) Mr. LEFEVRE.

104f and sp. **Genetics and Evolution.** A course of lectures dealing with the experimental study of genetics and its relation to problems of organic evolution. Emphasis is laid on the phenomena of Mendelian inheritance and the mechanism of heredity. (2) Mr. LEFEVRE.

105f. **Protozoology.** A study of the biology of protozoa, with emphasis upon their relation to vertebrates; methods of culture and general technique. Of special interest to students of medicine and agriculture. (2 or 3) Mr. CURTIS.

106w. **Parasitology.** A study of the fundamental principles of parasitology; life histories and behavior of animal parasites; effects produced upon their hosts by parasites. Of special interest to students of medicine and agriculture. (2 or 3). Mr. CURTIS.

120f and 121w. **Special Problems.** Preparation for research in zoology. Hours to be arranged. (3) Mr. LEFEVRE; Mr. CURTIS.

200f, 201w, 202sp and sm. **Research.** A reading knowledge of French and German is essential. Investigation of unsolved problems of zoology, in which the student is trained in the exercise of observation and thought. Hours to be arranged in accordance with the requirements of individual students. Mr. LEFEVRE; Mr. CURTIS.

210f, 211w, 212sp and sm. **Seminary.** A reading knowledge of French and German is desirable. Meetings at which subjects of zoological investigation are discussed by instructors and students. Each student is required to give at least four lectures during the year, and experience is thus gained in presenting, in the form of lectures, the results of reading and research. (1)

THE HISTORY OF ART

111f and 111sp. **History of Italian Renaissance Painting.** Illustrated lectures and collateral reading. (3) Mr. PICKARD.

112w. **History of Renaissance Painting in the Netherlands and in Germany.** Illustrated lectures and collateral reading. (3) Mr. PICKARD.

113f and 113sp. **Masterpieces of Architecture and Sculpture of Classic Times.** Lectures fully illustrated by use of lantern slides. (1) Mr. PICKARD.

115w and 115sm. **Masterpieces of Architecture, Sculpture, and Painting of Mediaeval and Modern Times.** Lectures fully illustrated by use of lantern slides. (1) Mr. PICKARD.

210f, 211w, and 212s. **Seminary.** Hours and work to be arranged. Mr. PICKARD.

Renaissance and Modern Painting: The collection of photographs, lantern slides, and other means of illustrating courses in these subjects

has been very largely increased. The picture gallery near the Museum of Classical Archaeology is hung with carbon photographs, photo-gravures, and other reproductions of masterpieces of painting.

THEORY AND PRACTICE OF ART

101w. **Psychological Principles of Art.** Prerequisite, course 2 and course 4; a course in the History of Art is advised in addition. (2) Mr. MEYER.

104f and sm. **Architecture.** Prerequisite, course 2; course 10 is advised in addition. A study of the essentials of architecture. (5) Mr. BILL.

105w and sm. **Pictorial Composition.** Prerequisite, course 4 or courses 2 and 10. Exception may be made to students possessing technique of photography. (5) Mr. ANKENY.

106w and sp. **Painting.** Prerequisite, course 4; course 10 is advised in addition. Lectures; practice in painting in several of the principal modes. (6) Mr. ANKENY.

107w and s. **Tone.** An advanced painting course. (2-5) Mr. ANKENY.

110w. **Planning of Domestic and Civic Buildings.** Prerequisite, courses 5 and 104. (5) Mr. BILL.

112f, w and s. **Newspaper Illustration.** Laboratory courses in general professional illustration. (5) Mr. ANKENY.

120w and s. **Life.** (3-5) Mr. ANKENY.

202w and s. **Problems of Design.** (2) or (5) Mr. ANKENY; Mr. BILL.

204w and s. **Problems of Form.** (2) or (5) Mr. ANKENY.

208w and s. **Traditions of Painting.** (2) or (3) Mr. ANKENY.

HOME ECONOMICS

101f. **House Sanitation.** Prerequisite, physiology, bacteriology, or preventive medicine. A study of the situation, ventilation, heating, lighting, water supply, drainage and care of the house with reference to health, convenience, and cost. These problems will be considered from the sanitary as well as the practical standpoint. Public sanitation, as it relates to the household, is considered. (3) Miss NAYLOR.

100w. **House Planning and Furnishing.** Prerequisite, course 101f; preceded or accompanied by design. A study of the planning and furnishing of the house from the standpoint of convenience, economics, health, and art. The type of house is considered in relation to surroundings, materials used, size, cost and adaptability to special needs of the family. House plans are studied and the equipment and decoration of each room is considered in detail, convenience and cost being especially emphasized. Each student plans and furnishes a house to suit certain definite conditions. (3) Miss GLEASON.

115f, w and s. **Household Management.** With supervised laboratory work in a self-sustaining practice-house. In order to be admitted to this course, students should make application at least two months before the opening of the term in which the course is desired.

(3) Miss NAYLOR.

120f and s. **Food and Nutrition.** Prerequisite, organic chemistry, physiology, bacteriology, home economics 11w. A study of the chemistry of the foodstuffs and their occurrence in the different food materials; the digestion, absorption, and utilization of the foodstuffs, and the digestibility of different food materials and combinations; the preservation and adulteration of foods.

Laboratory work in chemical analysis and digestion experiments as related to work in food preparation and preservation. (5) Miss STANLEY; Miss LHAMON.

121w. **Dietetics.** Prerequisite, course 120 and its prerequisites. A study of normal food requirements and the nutritive value of different food materials and combinations. Diets are planned to meet definite conditions, and the meals prepared and served. The cost of the dietary and the relation between nutritive value and cost is emphasized. A special study is made of infant feeding, the feeding of children, and school lunches. (3) Miss LHAMON.

130f. **Metabolism and Dietetics.** Prerequisite, course 121 and its prerequisites. A consideration of the process of metabolism with particular attention to the elimination of metabolism with particular attention to the elimination of metabolic end-products and their significance. The amount of food required to maintain the body in health is considered and the factors that determine this amount are worked out. Abnormal metabolic processes are considered as they throw special light on the problems of dietetics. (5) Miss STANLEY.

151f and s. **The Clothing Problem.** Prerequisite, course 51 or 52, physiology, and organic chemistry. A study of the selection, construction, and care of clothing for the infant child and the adult from the hygienic, social, and economic standpoints. This includes a study of the textile fabrics, their characteristics, manufacture, and cost, and the problem of household linens. (5) Miss GLEASON.

152w and s. **Advanced Clothing.** Prerequisite, course 151 and design. A continuation of course 151, with special application of the principles of art, economics, sociology, and hygiene to the costume. (5) Miss GLEASON.

200f, w, and s. **Home Economics Seminary.** The most recent work in various lines of home economics will be reviewed and discussed. The line of work considered will be changed each term, so as to cover the field as comprehensively as possible. Open only to especially prepared seniors and graduates. (1) Miss STANLEY.

201f, w, and s. **Research in Food Preparation.** Special problems in the field of food preparation will be taken up for investigation.

Open only to those who have had course 120 and chemistry 25 or its equivalent. A knowledge of French and German is desirable. Miss STANLEY.

220w. **Problems in Nutrition.** Prerequisite, course 121w. An intensive study will be made of special problems of interest in nutrition. Each student will investigate a nutritional problem in the laboratory and write a report upon same. Credit according to amount of work done. Miss STANLEY.

250f, w, and s. **Research in Clothing.** Open only to those who have had all the undergraduate courses in clothing. A study of the problems involved in the hygiene and economics of the clothing supply. A reading knowledge of French and German is desirable. Credit according to the amount of work done. Miss GLEASON.

GROUP OF AGRICULTURE

AGRICULTURAL CHEMISTRY

101f, w, and s. **Advanced Agricultural Analysis.** A continuation of the regular undergraduate course in agricultural chemistry, which is required of all undergraduate students in agriculture. A critical study of methods in use in the chemical laboratories of the experiment station will be made, including an examination of foods and feeding stuffs for adulteration, etc. The emphasis of the laboratory work depends upon the line of interest of the student. Three to five periods per week, including one lecture or recitation each week. Hours to be arranged. (3-5) Mr. MOULTON; Mr. HAIGH.

200f and 201w. **Seminary.** (1) Mr. MOULTON.

203w. **Chemistry of the Proteins.** A critical study of the composition and classification and of the decomposition products of the meat and vegetable proteins. Lectures and recitations. (3) Mr. MOULTON.

204f. **Physiological Chemistry of the Domestic Animal.** Designed to meet the requirements of students fitting themselves for investigation in animal nutrition. (3) Mr. PALMER.

205f and 206w. **Research.** This course may be elected either as major or minor and may include a thesis showing the results of the investigations. The chemical laboratories offer exceptional facilities for research. Subjects may be selected in (a) animal nutrition; (b) composition of animal fats as affected by feeding, age, breed, etc.; (c) the composition of meats, feeding stuffs, fertilizers, soils, etc.; (d) the chemical problems involved in the dairy industries; (e) the distribution of phosphorus in the animal organism with special reference to the separation of phosphorous compounds; (f) chemical problems involved in the enforcement of state and national pure food laws; (g)

the separation of proteins of flesh and study of their hydrolytic cleavage products; (h) the composition of the ash of the animal body as affected by age and nutrition. (3-6) Mr. MOULTON; Mr. HAIGH; Mr. PALMER.

ANIMAL HUSBANDRY

100f. **Animal Nutrition.** Prerequisite, organic chemistry, course 15. The laws of animal nutrition; an adaptability of the facts of physiological chemistry to the subject of feeding domestic animals. (3) Mr. ALLISON.

101w. **Animal Breeding.** Prerequisite, zoology, course 1. A treatment of the principles and practices involved in the improvement of domestic animals. The course includes a discussion of the subjects of reproduction, variation, heredity, selection, line breeding, inbreeding, crossbreeding, grading, and other subjects correlated with the breeding and improvement of farm animals. (3) Mr. TROWBRIDGE.

102f. **Advanced Live Stock Judging.** Prerequisite, course 3. A continuation of the work given in course 3 by the method of comparative judging. This course includes excursions to live stock shows and noted breeding farms. (3)

103w. **Beef Production.** Prerequisite, courses 1 and 100. A discussion of practical methods of beef production, including a consideration of successful practices in feeding for market, fitting for show, and general care and management of beef cattle. (3) Mr. ALLISON.

104w. **Sheep Production.** Prerequisite, courses 1 and 100. Best systems of sheep husbandry; rearing for mutton and wool; production of spring lambs; fattening sheep and lambs for the market; general care and management of the breeding flock. (2)

105w. **Pork Production.** Prerequisite, courses 1 and 100. Approved systems of swine management, including a discussion of food-stuffs, with special reference to their adaptability to pork production; the feeding and management of the commercial and purebred breeding herd. (2) may be extended to (3), the additional hour to consist of a discussion of modern breed history and pedigree work with swine. Mr. WEAVER.

106w. **Horse Production.** Prerequisite, courses 1 and 100. Statistical study of the horse and mule industry. Advanced study of the breeds and market types; horse pedigree record associations and stallion laws. The breeding, growing, and management of breeding and market horses of all classes. (2) Mr. TROWBRIDGE.

107w. **Stock Farm Management.** Successful methods of operating farms devoted chiefly to live stock production. A study of the best systems applied to Missouri conditions. (2) Mr. TROWBRIDGE.

108w. **Grazing.** A study of grazing and breeding problems in the production of cattle, sheep, and horses, and practice in live stock

judging. Four times a week during the first half of the winter term. Laboratory two hours a week. Mr. ALLISON.

200f and 201w. **Seminar.** Elective. Special investigation bearing on selected lines in animal husbandry. The preparation and presentation of papers for discussion by the class. Once a week. Mr. TROWBRIDGE.

202f and 203w and 204ss. **Research in Animal Husbandry.** Advanced studies of special phases of animal production. Recommended to students who desire more thoro training in the production of cattle, horses, sheep, or swine, or who may wish to make a more careful study of the fundamental principles of animal husbandry. Mr. TROWBRIDGE; Mr. ALLISON.

205f and 206w and 207ss. **Animal Breeding.** Research in special subjects bearing on the inheritance and development of characters in the domestic animals. Mr. MUMFORD.

208f and 209w and 210ss. **Animal Nutrition.** The most recent scientific publications relating to the nutrition of animals. Lectures; conferences; assigned readings. Mr. ALLISON.

DAIRY HUSBANDRY

100w. **Milk Production.** The breeds of dairy cattle; selection, breeding, and development of a dairy herd; care and management of dairy cattle; feeding for milk production; production of certified and market milk; milk for butter-making and cheese-making; utilization of by-products of the dairy. Mr. RAGSDALE; Mr. SWETT.

105w. **Dairy Chemistry.** A study of the chemical composition of milk and its products, and the chemical factors involved in the various phases of dairy technology. Mr. PALMER.

201f, w, and s. **Seminary.** The object of this course is to train the student to do independent work and to develop the spirit of research. It consists of special investigation and study along selected lines of research with review and discussions of recent work. Each student presents papers on selected topics and reports on recent scientific investigations and on current literature of the subject. Mr. RAGSDALE.

203f, w, and s. **Research in Dairy Husbandry.** A large herd of highly developed dairy cattle representing four breeds makes it possible to offer facilities for study and investigation of a variety of subjects pertaining to milk production and the care and management of dairy cattle. Students interested in this line are allowed to carry out certain experiments with the dairy animals and in some cases to assist in lines of investigations under way in the Agricultural Experiment Station. Mr. RAGSDALE.

207f and 208w. **Special Investigation in Composition of Milk.** The chemical composition of milk, butter, cheese, etc., and the factors

influencing their composition offer many attractive problems for graduate research. Unusual facilities are offered graduate students of good training in organic or agricultural chemistry to carry on independent investigations along the lines mentioned. The results obtained are usually of such a character that they can be published in one of the chemical journals. Mr. PALMER.

209f and 210w. **Dairy Manufactures.** Opportunity and facilities are given to study and investigate problems in butter-making, cheese-making, and other lines of dairy manufactures. Mr. COMBS.

ENTOMOLOGY

115w. **Relation of Insects to Disease.** A detailed study of the transmission of disease by insects, together with their life history, prevention, and control. One lecture and two laboratory periods. (3) Mr. HASEMAN; Mr. SULLIVAN.

116f. **Morphology, Histology, and Development of Insects.** A technical study of the development of the insect from the egg to the adult. Special emphasis is placed on the study of the different tissues of the insect's body, the origin and development of the different structures of both the immature and the mature insect, and the changes the insect undergoes. In the laboratory the student is required to give special attention to the preparation of material for sectioning, the manipulation of the microtome, and the staining, mounting, and studying of serial sections. Lectures and laboratory work. (3) Mr. HASEMAN.

200f, 210w and 202s. **Research.** Opportunity is offered for original investigations in economic entomology, systematic entomology, and insect morphology. Mr. HASEMAN and Mr. SULLIVAN.

203f, 204w, and 205s. **Seminary.** Reviews of current literature and reports on original investigations are presented and discussed by the students and members of the faculty. (1) Mr. HASEMAN.

FARM CROPS

101w. **Cereal Crops.** Prerequisite, course 1. An advanced course dealing with the principal cereal crops, based largely on a study of experimental data. Two lectures and three laboratory periods a week. (5) Mr. ETHERIDGE.

102f. **Forage Crops.** Prerequisite, course 1. An advanced course dealing with the principal forage plants. Based largely on a study of experimental data. Two lectures and three laboratory periods a week. (5) Mr. HELM.

103f. **Fiber Crops.** Prerequisite, course 1. An advanced course dealing with the principal fiber crops, with special study of cotton. (2) Mr. ETHERIDGE.

104f and sp. **Field Crop Improvement.** Prerequisite, course 1. A study of the laws of variation and heredity, the theory of mutation, the pure line theory, and Mendelism, as applied to the breeding of the principal farm crops. (3) Mr. STADLER.

105f, w, and s. **Special Problems.** Primarily for advanced undergraduates who show proper preparation. Topics will be assigned or may be chosen subject to approval. Mr. ETHERIDGE; Mr. HELM; Mr. STADLER.

201f, w, and s. **Research.** Original research in problems pertaining to the production, management, and improvement of farm crops. Mr. ETHERIDGE.

202f and w. **Seminary.** Discussion of various phases of investigation pertaining to the production, management, and improvement of farm crops. Papers on assigned topics are presented by the students. Required without credit of graduate students majoring in Farm Crops. (1) Mr. ETHERIDGE.

FARM MANAGEMENT

112f. **Farm Management Survey Methods.** Prerequisite, course 105. A study of farm financial surveys, enterprise surveys, and the general use of agricultural statistics in developing farm management principles. Special attention is paid to the recent use of such information in land appraisal work. Two lectures a week. (2) Mr. GREEN.

113w. **Farm Administration.** Not given in 1918-19. Prerequisite, course 110. The application of the general principles gathered in course 110w to special farms. One lecture and one laboratory a week. (2) Mr. JOHNSON.

151f and 152w. **Special Problems in Farm Administration.** Not given in 1918-19. Prerequisite, courses 105, 110, and 112. A detailed study of the farm layout, methods of handling labor, and the utilization of capital on an approved farm. Keeping detailed records and the spending of some time on the farm studied will be an important part of the work. Thesis required. Hours to be arranged. Mr. JOHNSON; Mr. GREEN.

200f and 201w. **Seminary.** Selected literature and special field investigations of farm management problems. Mr. JOHNSON; Mr. GREEN.

202f and 203w. **Investigation of Systems of Farm Organization and Farm Practices.** A study of systems of farm organization with emphasis on the details of this organization made by means of agricultural surveys and detailed cost accounting records. Thesis required. Mr. JOHNSON; Mr. GREEN.

HORTICULTURE

105f. **Systematic Pomology.** A study of the classification, nomenclature, and adaptation of fruit varieties. Lectures and assigned readings. (3) Mr. GARDNER.

106f. **Commercial Vegetable Growing.** An intensive study of methods of production, harvesting, grading, packing, and storage of the leading vegetables grown on a commercial scale. The use of irrigation, fertilizers, spraying equipment, and forcing structures in vegetable growing, and discussions on seed growing, labor problems, truck farm management, cooperation, and methods of marketing for vegetable growers. Two lectures and one laboratory period. (3) Mr. ROSA.

107f. **Plant Material: Trees.** Practical courses designed to familiarize the student with the character, habits, and adaptation of native and cultivated trees used in cities, parks, and private estates; designed to train students for the positions of park superintendent, city forester or warden, nurseryman or landscape plantsman, and includes tree shaping and surgery, practicum, and field work. (2) Mr. MAJOR.

108w. **Plant Material: Shrubs and Vines.** A study of ornamental shrubs and vines used in landscape gardening. One lecture and two laboratory periods. (3) Mr. MAJOR.

112w. **Advanced Landscape Design.** A study of the theory and principles of landscape design, together with tracings and original designs in home, school, church, cemetery, and railroad gardening. Prerequisite, 12f, 107f and 108w. (3) Mr. MAJOR.

116f, 117w, and 118s. **Special Problems.** Primarily for advanced undergraduates. Topics in landscape gardening, pomology, or vegetable gardening will be assigned to students who have adequate preparation. Hours by appointment. Mr. GARDNER; Mr. TALBERT; Mr. HOOKER; Mr. MAJOR; Mr. ROSA.

119w. **Vegetable Forcing.** The location, construction and management of greenhouses and forcing frames for vegetables, with detailed discussions on culture of each group commonly grown under glass. Practice in greenhouse work and methods of growing early vegetable plants for sale. Spraying, fumigation, and soil fertilization practice. Two lectures and one laboratory period. (3) Mr. ROSA.

121s. **Fruit Varieties.** A systematic study of species, types, varieties, and strains of fall and winter fruits. A laboratory course. (2) Mr. SWARTWOUT.

122f. **Fruit Varieties.** A systematic study of species, types, varieties, and strains of fall and winter fruits. A laboratory course (2) Mr. SWARTWOUT.

123f. **Systematic Olericulture.** A systematic study of the common varieties of vegetables; laboratory and field studies of the characteristics and adaptability of the various types, varieties, and strains of the most important vegetables; vegetable judging and preparation of

vegetable exhibits. One lecture and two laboratory periods. (3) Mr. ROSA.

125s. **Advanced Plant Breeding.** Prerequisite, course 115. A critical study of the methods employed and results obtained in recent plant breeding investigations. Laboratory work to acquaint the student with the technique of plant breeding operation. (3) Mr. GARDNER.

130w. **History and Literature of Horticulture.** A consideration of the more important factors in the evolution of horticultural science and of the influence of its more important workers and literature. Lectures and assigned readings. (2) Mr. GARDNER.

220f, 201 w, 202s. **Special Investigations.** For graduates and advanced students. Special problems involving original investigations. Hours by appointment. Mr. GARDNER; Mr. TALBERT; Mr. HOOKER; Mr. MAJOR; Mr. ROSA.

210f. **Methods of Research.** A study of methods of procedure in work of investigation—outlining problems, assembling and analyzing data, and presenting results. Lectures, assigned readings, and problems. (2) Mr. HOOKER.

211w **Methods of Extension.** A study of methods of procedure in Extension work in horticulture. Lectures, assigned readings, and problems. (2) Mr. TALBERT.

215f and 216w. **Seminary.** A critical study of recent investigations in horticulture and of investigations in other fields, as they relate to horticulture. (1) Mr. HOOKER; Mr. GARDNER.

SOILS

101f and s. **Advanced Soil Fertility.** Prerequisite, course 1. An advanced course dealing primarily with soil fertility. Laboratory exercises may include work on soils from the home farms of students. One lecture, two laboratory periods. (3) Mr. MILLER; Mr. HUDELSON; Mr. ALBRECHT.

102w. **Soil Surveying.** Prerequisite, course 1. Actual field practice in mapping soils and in the preparation of detailed soil maps. Course designed to fit men for soil survey field work. (2) Mr. KRUSEKOPF.

104f. **Soils of the United States.** Prerequisite, course 1. The soils of the United States, their characteristics, crop adaptations, and the systems of farming to which they are adapted. Particular attention given to the soils of Missouri. (2) Mr. MILLER.

105w. **Soil Bacteriology.** Prerequisite, general bacteriology. Microorganic life of the soil in relation to soil fertility, including studies of nitrogen transformations, decay of farm manures, soil inoculation, and other biological processes. One lecture, two laboratory periods. (3) Mr. ALBRECHT.

106f, 107w, and 108s. **Special Problems.** Assigned problems in soil physics, fertility or biology in connection with certain experiment station projects, or problems chosen by the students with approval. Hours by arrangement. (2-5) Mr. MILLER; Mr. HUDELSON; Mr. ALBRECHT.

200f and 201w. **Seminary.** Discussions of recent developments in soil science. Papers on assigned topics are presented for discussion. (1) Mr. MILLER.

205f, 206w, and 207s. **Soil Research.** Special investigations in soils. Mr. MILLER; Mr. HUDELSON; Mr. ALBRECHT.

VETERINARY SCIENCE

204f and 205w. **Contagious, Infectious, and Parasitic Diseases of Farm Animals.** In this course an effort is made to present as many clinical cases as possible, in order that the student may gain a practical knowledge of the clinical features as they are encountered in field experience. Experimental inoculations supplement the clinical study. Autopsies are made and the gross and microscopic lesions studied. The specific causes (bacteria and other micro-parasites and macro-parasites), where known, are isolated and studied. The specific diagnostic tests such as the tuberculin tests, mallein tests, agglutination and complement fixation tests for abortion diseases, etc. are studied, as well as the methods of preparation and use of the specific immunizing agents—hog cholera serum, blackleg and rous vaccines, and the aggressins and bacterins. (3) Mr. CONNAWAY.

208f and 209w. **Research.** Experimental investigation of animal diseases and of measures of prevention and treatment. Open to graduate students who have the requisite preparation. The student may assist in Experiment Station projects now in progress or may be assigned a special problem. (3) or (6) Mr. CONNAWAY; Mr. DURANT.

GROUP OF ENGINEERING

CHEMICAL ENGINEERING

For the courses in Chemical Engineering see Chemistry, courses 110f, w, sp., 112w, 121f, w, sp, sm, 122f, w, 131f, 133w, 141f, 142w.

CIVIL ENGINEERING

113w. **Economics of Railway Construction.** Prerequisite, course 111. The economic effect of changes in distance, curvature, rise and fall, grades, etc. (2) Mr. MILLER.

141f. **Water Power.** Hydrology; stream measurement, weirs, current meters; storage reservoirs, dams; water wheels; the problem of a water power development. (3) Mr. RODHOUSE.

157w. **Sanitation and Sanitary Design.** General sanitation; garbage reduction; street cleaning; design of works for sewage disposal and water purification. (2) Mr. McCAUSTLAND.

201w. **Geodetic Surveying.** Elements of geodesy, with practice in use of precise instruments and reduction of triangulation. (3) Mr. WILLIAMS.

214w. **Railway Maintenance.** Maintenance of track; signals; organization of engineering department; accounting. (3) Mr. MILLER.

215w. **Railway Yards and Terminals.** Arrangement of terminal facilities for handling of both passenger and freight business; design, construction, and operation of yards of several kinds and types. (2) Mr. MILLER.

222f. **Structural Design.** Design of wooden stringer bridge, I-beam stringer bridge, and steel railway truss bridge, with working drawings and estimates. (3) Mr. HYDE.

223w. **Higher Structures.** Swing bridges; arches; suspension and cantilever bridges; deflection of trusses. (3) Mr. HYDE.

226f. **Concrete Structures.** Theory of reinforced concrete structures with problems in design. (3) Mr. SPALDING.

227w. **Theory of Structures.** Statically indeterminate structures; secondary stresses. Credit to be arranged. Mr. HYDE.

231f. **Experimental Investigation.** Hydraulic laboratory. Laboratory investigations concerning the properties and uses of the materials of construction. Credit to be arranged. Mr. LARUE.

243f. **Irrigation and Drainage.** Irrigation engineering, institutions, and practice; canals; ditches, reservoirs; land drainage. (2) Mr. RODHOUSE.

244w. **Rivers and Canals.** River improvements, training works, floods, levees, dredging, shore protection; waterways, canals and locks; river discharge. (2) Mr. RODHOUSE.

251f. **Sanitary Engineering.** Investigations and special problems in sanitary engineering. Credit to be arranged. Mr. McCAUSTLAND.

ELECTRICAL ENGINEERING

131w. **Electric Motors.** Prerequisite, course 101. Construction, characteristics, and application of electric motors to various classes of service. (2) Mr. WEINBACH.

132f. **Storage Battery Engineering.** Prerequisite, course 102f. Theory, operating characteristics, and application of electric storage batteries. (2) Mr. WEINBACH.

133f. **Illumination.** Prerequisite, course 101. Characteristics of commercial types of electric lamps and their application to interior and exterior lighting. (2) Mr. SAVANT.

134w. **Telephony.** Prerequisite, course 110f. Design and operation of telephone systems. Switchboard systems. Types of line construction. A few periods are devoted to laboratory work. (2) Mr. SAVANT.

143f. **Electrical Processes.** Not offered in 1919-20. Prerequisite, course 101. Miscellaneous practical applications of electricity in electrochemical and metallurgical industries, including electroplating; electric welding; the theory, construction, and operation of electric furnaces. (2) Mr. WEINBACH.

221f. **Problems in Alternating Current Design.** Prerequisite, courses 111 and 120. Rational treatment of design problems relating to alternating current machinery. (2) Mr. LANIER.

230f. **Generation and Distribution.** Prerequisite, course 111w. Detailed study of the generation, transmission, and distribution of electrical energy for lighting, power, and electric railways. (3) Mr. WEINBACH.

240w. **Central Station Design.** Prerequisite, course 230f. Selection and arrangement of equipment of electric power plants. Plans and designs of power plant. (2) Mr. LANIER.

241w. **Electric Railway Engineering.** Prerequisite, course 103f and 111w. Electric railway systems; equipment and operation. Economic conditions governing the construction of an electric road. (2) Mr. SAVANT.

242w. **Transmission.** Prerequisite, course 230f. Transmission of electric power. Line regulation. Economical aspects, practical limitations, operating precautions. (3) Mr. WEINBACH.

244w. **Analysis of Design Problems.** Prerequisite, course 221f. An analysis of some of the more important problems relating to the design of electrical machinery. (2) Mr. LANIER.

250f. **Special Electrical Laboratory.** This course will be adapted to meet the attainments of individual students. Definite problems will be assigned which must be studied by existing literature and by experimental work. (2) Mr. LANIER.

280w. **Applications of Mathematics to Electrical Engineering.** Prerequisite, mathematics course 6. Stating the problem in mathematical form; approximate solutions; derivations of empirical formulae; solutions of equations by graphical methods; application of complex numbers, exponential functions, and differential equations to electrical engineering problems. (2) Mr. WEINBACH.

290. **Research.** Original investigations along various lines in electrical engineering. Students taking research work will have as advisers those members of the staff most conversant with the problem undertaken.

MECHANICAL ENGINEERING

201f and w. **Special Machine Design.** Advanced work in kinematics, graphics, materials and design of apparatus and machinery for the specific work. Credit to be arranged. Mr. FOSTER.

211w. **Shopwork Engineering.** Advanced analysis in production-engineering. Industrial betterment. New mechanisms in scientific management. Tests in laboratory and in commercial plants. (2) Mr. HIBBARD.

221f and w. **Special Mechanical Laboratory.** Advanced work in experimental engineering research. Credit to be arranged. Offered by members of the staff in their respective lines.

234f and 235w. **Gas Engineering.** Prerequisite, machine design, B, heat machinery, B. Production, preparation, transmission, and utilization of industrial gases; together with the theory and practice of internal-combustion motors. (2) Mr. WHARTON.

251w. **Refrigeration, B.** Prerequisite, refrigeration, A. Designs, plans, specifications, estimates for one or more selected studies, as: ice factory, cold-storage, district refrigeration, nursery, market, etc. Research, tests, improvements, appraisals, sales, management. Credit to be arranged. Mr. WHARTON.

261f and 262w. **Railway Mechanical Engineering.** Prerequisites vary with group elected. 1. Locomotive design. 2. Locomotive operation. 3. Car design. 4. Railway shops. (2) Mr. HIBBARD.

231w. **Applied Thermodynamics.** Prerequisite, heat machinery, B. The advanced theory and practice of heat transformations and appliances related to commercial economy in heat machinery. (3) Mr. WHARTON.

MECHANICS

112f and 113w. **Advanced Mechanics.** Problems in dynamics. (3) Mr. DEFOE.

205f and 206w. **Elasticity.** Mathematical theory of elasticity. (3) Mr. DEFOE.

209f and 210w. **Hydrodynamics.** Material theory of the motion of fluids (2) Mr. DEFOE.

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- CHESTER MURRAY, Ph. B., Ph. D.,
Associate Professor of Romance Languages.
- ROBERT LEE RAMSAY, A. B., Ph. D.,
Associate Professor of English.
- HERBERT MEREDITH REESE, A. B., Ph. D.,
Associate Professor of Physics.
- THOMAS JACOB RODHOUSE, B. S. in C. E., M. C. E.,
Associate Professor of Hydraulic Engineering.
- FRANK FLETCHER STEPHENS, Ph. B., Ph. M., Ph. D.,
Associate Professor of American History.
- WILLIAM ARTHUR TARR, B. S. in Min. Eng., Ph. D.,
Associate Professor of Geology and Mineralogy.
- JACOB WARSHAW, A. B., A. M., Ph. D.,
Associate Professor of Romance Languages.
- MENDEL PENCO WEINBACH, A. B., B. S. in E. E., A. M.,
Associate Professor of Electrical Engineering.
- WILHELMUS DAVID ALLEN WESTFALL, A. B., Ph. D.,
Associate Professor of Mathematics.
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Associate Professor of Mechanical Engineering.
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Assistant Professor of Dairy Husbandry.
- JAMES ANDREW GIBSON, A. B., A. M.,
Assistant Professor of Analytical Chemistry.
- ROY MONROE GREEN, B. S. in Agr.,
Assistant Professor of Farm Management.
- LEONARD DIXON HAIGH, B. S., M. S., Ph. D.,
Assistant Professor of Agricultural Chemistry.
- CHARLES ALLEN HELM, B. S. in Agr., A. M.,
Assistant Professor of Farm Crops.
- HENRY DAGGETT HOOKER, A. B., A. M., Ph. D.,
Assistant Professor of Horticulture.
- ROBERT R. HUDELSON, B. S., A. M.,
Assistant Professor of Soils.

- LOUIS INGOLD, A. B., A. M., Ph. D.,
Assistant Professor of Mathematics.
- HORACE FAIRCHILD MAJOR, B. S. A.,
Assistant Professor of Landscape Gardening, and Superintendent of
Grounds.
- WILLIS EDGAR MANEVAL, Ph. B., M. S., Ph. D.,
Assistant Professor of Botany.
- JOHN WESLEY MARDEN, B. S., M. S., D. Sc.,
Assistant Professor of Chemistry.
- BESS NAYLOR, B. S. in Ed., A. M.,
Assistant Professor of Home Economics.
- LEROY SHELDON PALMER, B. S. in Ch. E., A. M., Ph. D.,
Assistant Professor of Dairy Chemistry.
- WILLIAM HENRY PYLE, A. B., Ph. D.,
Assistant Professor of Educational Psychology.
- JAMES WALTER RANKIN, A. B., A. M., Ph. D.,
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- D R SCOTT, A. B. B. S. in Jour.,
Assistant Professor of Economics.
- CAROLINE TAYLOR STEWART, A. B., A. M., Ph. D.,
Assistant Professor of Germanic Languages.
- CARL CLEVELAND TAYLOR, A. B., A. M., Ph. D.,
Assistant Professor of Sociology.
- HARVEY ALDEN WOOSTER, A. B., A. M., Ph. D.,
Assistant Professor of Economics.
- WILLIAM ALBERT ALBRECHT, A. B., B. S., M. S. in Agr.,
Instructor in Soils.
- HARRY SATTERLEE BILL,
Instructor in Theory and Practice of Art.
- SAM TILDEN BRATTON, A. B., A. M.,
Instructor in Geology and Geography.
- EMMA CAUTHORN, A. B.,
Instructor in Latin.
- ROBERT MERRILL DEWEY, B. S.,
Instructor in English.
- MARY VIOLETTE DOVER, A. B., M. Sc., Ph. D.,
Instructor in Chemistry.
- HELEN GLEASON,
Instructor in Home Economics.
- FRANCES VIRGINIA GUTHRIE, A. B., B. S., A. M.,
Instructor in Pathology.
- GERMAINE SANSOT HUDSON,
Instructor in French.

- ALBERT PARSONS LEWIN, A. B., A. M.,
Instructor in English.
- CLARA LOIS LHAMON, A. B., A. M.,
Instructor in Home Economics.
- ALFRED HENRY NOLLE, A. B., B. S. in Ed., A. M., Ph. D.,
Instructor in Germanic Languages.
- JULIUS JOHN OPPENHEIMER, B. S. in Ed., A. M.,
Instructor in School Supervision, and leading Supervisor in the
University High School.
- JAMES HARVEY ROGERS, B. S., A. B., A. M., Ph. D.,
Instructor in Economics.
- JOSEPH TOOKER ROSA, Jr., B. S., M. S.,
Instructor in Horticulture.
- DOM. PETER SAVANT, B. S. in E. E., M. S., E. E.,
Instructor in Electrical Engineering.
- KNOWLES CLARK SULLIVAN, B. S. in Agr.,
Instructor in Entomology, and Deputy Inspector of Nurseries.
- HAROLD GORDON SWARTWOUT, B. S. in Agr.,
Instructor in Horticulture.
- WALTER WHITTIER SWETT, B. S., A. M.,
Instructor in Dairy Husbandry.
- GEORGE WASHINGTON TANNREUTHER, A. B., A. M., Ph. D.,
Instructor in Zoology.
- RALPH K. WATKINS, B. S. in Ed.,
Instructor in School Supervision.

FELLOWS AND SCHOLARS

University Fellows

- ALVIN LAMAR WILLS, A. B., Transylvania College, A. M. Columbia
University, B. D. Union Theological Seminary.
Sociology.

Peabody Fellow in Education

- BRUCE LEE MELVIN, B. S. in Ed. University of Missouri, A. M. Uni-
versity of Missouri.

University Scholars

- NEWMAN FREESE BAKER, A. B. Southwestern College.
Political Science.
- MARY LOUISE REID BROWN, A. B. Smith College.
Sociology.
- MARJORIE KATHERINE CARPENTER, A. B. University of Missouri, B. S. in
Ed. University of Missouri.
Latin.
- BELMONT MERCER FARLEY, B. S. Warrensburg State Normal School.
Education.

GILBERT PARVIN MOORE, A. B. University of Missouri.
Geology.

Peabody Scholar in Education

BARNEY ELIC MILLER, B. S. in Ed. University of Missouri.

Agricultural Research Fellow

JAMES RENFREW DICE, A. B. Westminster College, B. S. Michigan Agricultural College.

Dairy Husbandry.

Agricultural Research Scholar

JOHN HARWOOD LONGWELL, B. S. in Agriculture, University of Missouri.
Animal Husbandry.

INFORMATION ABOUT THE UNIVERSITY

GENERAL STATEMENT

The fundamental aim of the University of Missouri is the development of the highest and most efficient type of citizen. For the purpose of attaining its aim, the University furnishes ample facilities for liberal education and for thorough professional training. The University is a part of the public educational system of the state.

ORGANIZATION

The work of the University is now carried on in the following divisions:

- College of Arts and Science
- College of Agriculture
- School of Education
- School of Law
- School of Medicine
- School of Engineering
- School of Mines and Metallurgy
- School of Journalism
- School of Business and Public Administration
- Graduate School
- Extension Division

All of these divisions are at Columbia, with the exception of the School of Mines and Metallurgy, which is located at Rolla. In addition, emphasis is given particular lines of work by the establishment of minor divisions, the chief of which are the Agricultural Experiment Station,

the Engineering Experiment Station, and the Missouri State Military School.

LOCATION

The University of Missouri is located at Columbia, situated half way between St. Louis and Kansas City, near the center of the state. It is reached by the Wabash and by the Missouri, Kansas and Texas railways. Columbia is a progressive and prosperous town having doubled its population in the last few years.

Columbia may be characterized as a town of school, homes, and churches, with enough of industrialism to make it efficient. It offers the convenience of a larger city without the counter attractions. The student is a predominant factor in Columbia.

EQUIPMENT

The University grounds cover more than 800 acres. The main divisions are in the west campus, the east campus, the athletic fields, and the University farm.

The following University buildings are located at Columbia: Academic Hall; Laws Observatory; separate buildings for chemistry, physics, biology, geology, engineering, manual arts, law, business and public administration; two power houses; Medical Laboratory Building; Parker Memorial Hospital; Agriculture Building; Horticulture Building; Schweitzer Hall for agricultural chemistry; green houses; Live Stock Judging, Poultry, Dairy, Farm Machinery, and Veterinary Buildings; the agricultural college farm barns and buildings; Switzler Hall for the School of Journalism; Gordon Hotel Building for home economics; Lathrop Hall, dormitory for men; Read Hall, dormitory for women; Rothwell Gymnasium; the houses for the President of the University and the Dean of the College of Agriculture; and High School and Elementary School buildings, used for practice schools in the School of Education. The new library building, containing the General Library and the State Historical Library, affords also commodious seminary rooms for the use of students in the graduate courses.

FOR FURTHER INFORMATION

For further information in regard to the Graduate School of the University, address

DEAN OF THE GRADUATE FACULTY,
UNIVERSITY OF MISSOURI,
COLUMBIA MISSOURI.

Full information regarding the University is given in the catalog, which will be sent on request without charge. For this or special bulletins of the College of Agriculture, School of Education, School of Law, School of Medicine, School of Engineering, School of Journalism, School of Business and Public Administration, Extension Division, and the Graduate School, write to

THE REGISTRAR,
UNIVERSITY OF MISSOURI,
COLUMBIA, MISSOURI.

UNIVERSITY CALENDAR

Session 1919-20

1919

FALL TERM

Aug. 26, 27, 28	Tuesday, Wednesday, Thursday, entrance examinations	
Aug. 29, 30	Friday, Saturday, registration	
Aug. 30, 7:30 p. m.	Saturday, opening convocation	
Sept. 1, 8 a. m.	Monday, class work begins	
Oct. 27, 8 a. m.	Monday, to	} First term, two-year winter course in agriculture
Dec. 20, noon	Saturday	
Nov 27	Thursday, Thanksgiving Day, holiday	
Dec. 20, noon	Saturday, fall term ends	
	Christmas Holidays	

WINTER TERM

Dec. 30	Tuesday, registration	
Dec. 30, 7:30 p. m.	Tuesday, opening convocation	
Dec. 31, 8 a. m.	Wednesday, class work begins	
Dec. 31, 8 a. m.	Wednesday, to	} Second term, two-year winter course in agriculture
1920		
Feb. 27, 4 p. m.	Friday	
Feb. 22	Sunday, Washington's Birthday	
April 18	Sunday, Baccalaureate Address	
April 20, 4 p. m.	Tuesday, winter term ends	
April 22	Thursday, Commencement Day	

SPRING-SUMMER TERM

April 24	Saturday, registration	
April 24, 7:30 p. m.	Saturday, opening convocation	
April 26, 8 a. m.	Monday, class work begins	
June 19	Saturday, first half of term ends	
June 21	Monday, second half of term begins	
Aug. 14, noon	Saturday, spring-summer term ends	

UNIVERSITY OF ILLINOIS-URBANA



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